



Service Manual

2005

Room Air Conditioners

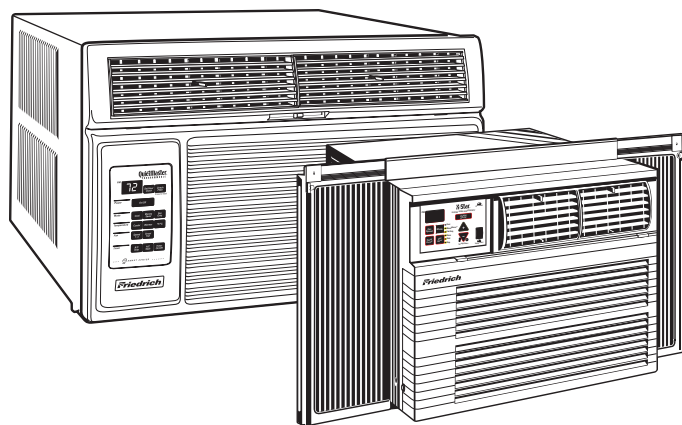


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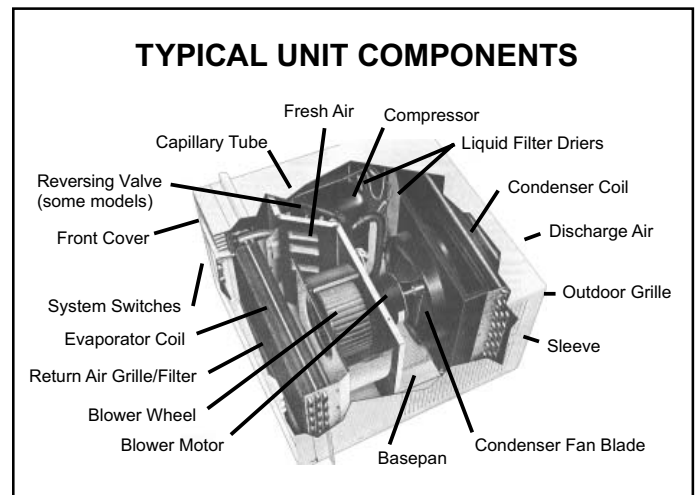
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INTRODUCTION

This service manual is designed to be used in conjunction with the installation manuals provided with each air conditioning system component.

This service manual was written to assist the professional RAC service technician to quickly and accurately diagnose and repair malfunctions.

This manual will deal with subjects in a general nature. (i.e. all text will not pertain to all models).



IMPORTANT: It will be necessary for you to accurately identify the unit you are servicing, so you can be certain of a proper diagnosis and repair (See Unit Identification).

WARNING

The information contained in this manual is intended for use by a qualified service technician who is familiar with the safety procedures required in installation and repair, and who is equipped with the proper tools and test instruments.

Installation or repairs made by unqualified persons can result in hazards subjecting the unqualified person making such repairs to the risk of injury or electrical shock which can be serious or even fatal not only to them, but also to persons being served by the equipment.

If you install or perform service on equipment, you must assume responsibility for any bodily injury or property damage which may result to you or others. Friedrich Air Conditioning Company will not be responsible for any injury or property damage arising from improper installation, service, and/or service procedures.

UNIT IDENTIFICATION

Model Number Code

S S 08 J 1 0 A

1st Digit – Function

S = Straight Cool, Value Series
Y = Heat Pump
E = Electric Heat
K = Straight Cool
R = Straight Cool
X = Straight Cool
W = Thru-the Wall,
WallMaster Series

2nd Digit

C = Casement
Q = Q-Star
S = Small Chassis
M = Medium Chassis
L = Large Chassis
H = HazardGard

3rd and 4th Digit - Approximate BTU/HR (Cooling)

Heating BTU/Hr capacity listed in the
Specification/Performance Data Section

8th Digit – Engineering

Major change

7th Digit – Options

0 = Straight Cool &
Heat Pump Models
1 = 1 KW Heat Strip, Normal
3 = 3 KW Heat Strip, Normal
4 = 4 KW Heat Strip, Normal
5 = 5 KW Heat Strip, Normal

6th Digit – Voltage

1 = 115 Volts
3 = 230-208 Volts

5th Digit

Alphabetical Modifier

RAC Serial Number Identification Guide

Serial Number Decade Manufactured L=0 C=3 F=6 J=9 A=1 D=4 G=7 B=2 E=5 H=8				L	C	G	S	00001 Production Run Number
Year Manufactured A=1 D=4 G=7 K=0 B=2 E=5 H=8 C=3 F=6 J=9								
Month Manufactured A=Jan D=Apr G=Jul K=Oct B=Feb E=May H=Aug L=Nov C=Mar F=Jun J=Sep M=Dec				Product Line R = RAC P = PTAC E = EAC V = VPAK H = Split				

INSTRUCTIONS FOR USING COOLING LOAD ESTIMATE FORM FOR ROOM AIR CONDITIONERS

(AHAM PUB. NO. RAC-1)

- A. This cooling load estimate form is suitable for estimating the cooling load for comfort air conditioning installations which do not require specific conditions of inside temperature and humidity.
- B. The form is based on an outside design temperature of 95°F dry bulb and 75°F wet bulb. It can be used for areas in the continental United States having other outside design temperatures by applying a correction factor for the particular locality as determined from the map.
- C. The form includes "day" factors for calculating cooling loads in rooms where daytime comfort is desired (such as living rooms, offices, etc.)
- D. The numbers of the following paragraphs refer to the corresponding numbered item on the form:
 - 1. Multiply the square feet of window area for each exposure by the applicable factor. The window area is the area of the wall opening in which the window is installed. For windows shaded by inside shades or venetian blinds, use the factor for "Inside Shades." For windows shaded by outside awnings or by both outside awnings and inside shades (or venetian blinds), use the factor for "Outside Awnings." "Single Glass" includes all types of single thickness windows, and "Double Glass" includes sealed airspace types, storm windows, and glass block. Only one number should be entered in the right hand column for Item 1, and this number should represent **only the exposure with the largest load.**
 - 2. Multiply the total square feet of **all** windows in the room by the applicable factor.
 - 3a. Multiply the total length (linear feet) of all walls exposed to the outside by the applicable factor. Doors should be considered as being part of the wall. Outside walls facing due north should be calculated separately from outside walls facing other directions. Walls which are permanently shaded by adjacent structures should be considered "North Exposure." Do not consider trees and shrubbery as providing permanent shading. An uninsulated frame wall or a masonry wall 8 inches or less in thickness is considered "Light Construction." An insulated wall or masonry wall over 8 inches in thickness is considered "Heavy Construction."
 - 3b. Multiply the total length (linear feet) of all inside walls between the space to be conditioned and any unconditioned spaces by the given factor. Do not include inside walls which separate other air conditioned rooms.
 - 4. Multiply the total square feet of roof or ceiling area by the factor given for the type of construction most nearly describing the particular application (use one line only.)
 - 5. Multiply the total square feet of floor area by the factor given. Disregard this item if the floor is directly on the ground or over a basement.
 - 6. Multiply the number of people who normally occupy the space to be air conditioned by the factor given. Use a minimum of 2 people.
 - 7. Determine the total number of watts for light and electrical equipment, except the air conditioner itself, that will be **in use** when the room air conditioning is operating. Multiply the total wattage by the factor given.
 - 8. Multiply the total width (linear feet) of any doors or arches which are continually open to an unconditioned space by the applicable factor.

NOTE: Where the width of the doors or arches is more than 5 feet, the actual load may exceed the calculated value. In such cases, both adjoining rooms should be considered as a single large room, and the room air conditioner unit or units should be selected according to a calculation made on this new basis.
 - 9. Total the loads estimated for the foregoing 8 items.
 - 10. Multiply the subtotal obtained in item 9 by the proper correction factor, selected from the map, for the particular locality. The result is the total estimated design cooling load in BTU per hour.
- E. For best results, a room air conditioner unit or units having a cooling capacity rating (determined in accordance with the NEMA Standards Publication for Room Air Conditioners, CN 1-1960) as close as possible to the estimated load should be selected. In general, a greatly oversized unit which would operate intermittently will be much less satisfactory than one which is slightly undersized and which would operate more nearly continuously.
- F. Intermittent loads such as kitchen and laundry equipment are not included in this form.

COOLING LOAD ESTIMATE FORM

HEAT GAIN FROM	QUANTITY	FACTORS DAY			BTU/Hr. (Quantity x Factor)
1. WINDOWS: Heat gain from the sun. Northeast _____ sq. ft. East _____ sq. ft. Southeast _____ sq. ft. South _____ sq. ft. Southwest _____ sq. ft. West _____ sq. ft. Northwest _____ sq. ft. North _____ sq. ft.	* These factors are for single glass only. For glass block, multiply the above factors by 0.5; for double glass or storm windows, multiply the above factors by 0.8.				
		No Shades*	Inside Shades*	Outside Awnings*	(Area X Factor)
		60	25	20	Use _____
		80	40	25	only _____
		75	30	20	the _____
		75	35	20	largest _____
		110	45	30	load. _____
		150	65	45	Use _____
		120	50	35	only _____
		0	0	0	one. _____
2. WINDOWS: Heat by conduction (Total of all windows.) Single glass _____ sq. ft. Double glass or glass block _____ sq. ft.					
3. WALLS: (Based on linear feet of wall) a. Outside walls North Exposure _____ ft. Other than North exposure _____ ft. b. Inside Walls (between conditioned and unconditioned spaces only.) _____ sq. ft.					
		Light Construction		Heavy Construction	
		30		20	
		60		30	
			30		
4. ROOF OR CEILING: (Use one only) a. Roof, uninsulated _____ sq. ft. b. Roof, 1 inch or more insulation _____ sq. ft. c. Ceiling, occupied space above _____ sq. ft. d. Ceiling, insulated, with attic space above _____ sq. ft. e. Ceiling, uninsulated, with attic space above _____ sq. ft.					
5. Floor: (Disregard if floor is directly on ground or over a basement.) _____ sq. ft.					
6. NUMBER OF PEOPLE _____ 600					
7. LIGHTS AND ELECTRICAL EQUIPMENT IN USE _____ watts 3					
8. DOORS AND ARCHES CONTINUOUSLY OPENED TO UNCONDITIONED SPACE: (TOTAL LINEAR FEET OF WIDTH.) _____ ft. 300					
9. SUBTOTAL *****					
10. TOTAL COOLING LOAD (BTU per hour to be used for selection of room air conditioner(s).) _____ Total in Item 9 X _____ (Factor from Map) = _____					

HEAT LOAD FORM

The heat load form on the following page may be used by servicing personnel to determine the heat loss of a conditioned space and the ambient winter design temperatures in which the unit will heat the calculated space.

The upper half of the form is for computing the heat loss of the space to be conditioned. It is necessary only to insert the proper measurements on the lines provided and multiply by the given factors, then add this result for the total heat loss in BTU/Hr./°F.

The BTU/Hr. per °F temperature difference is the 70°F inside winter designed temperature minus the lowest outdoor ambient winter temperature of the area where the unit is installed. This temperature difference is used as the multiplier when calculating the heat loss.

The graph shows the following:

Left Hand Scale	Unit capacity BTU/Hr. or heat loss BTU/Hr.
Bottom Scale	Outdoor ambient temperature, base point.
Heat Pump Model	BTU/Hr. capacity heat pump will deliver at outdoor temperatures.
Balance Point	Maximum BTU/Hr. heat pump will deliver at indicated ambient temperature.

Following is an example using the heat load form:

A space to be conditioned is part of a house geographically located in an area where the lowest outdoor ambient winter temperature is 40°F. The calculated heat loss is 184 BTU/Hr./°F.

Subtract 40°F (lowest outdoor ambient temperature for the geographical location) from 70°F (inside design temperature of the unit) for a difference of 30°F. Multiply 184 by 30 for a 5500 BTU/Hr. total heat loss for the calculated space.

On the graph, plot the base point (70°) and a point on the 40°F line where it intersects with the 5500 BTU/Hr. line on the left scale. Draw a straight line from the base point 70 through the point plotted at 40°F. This is the total heat loss line.

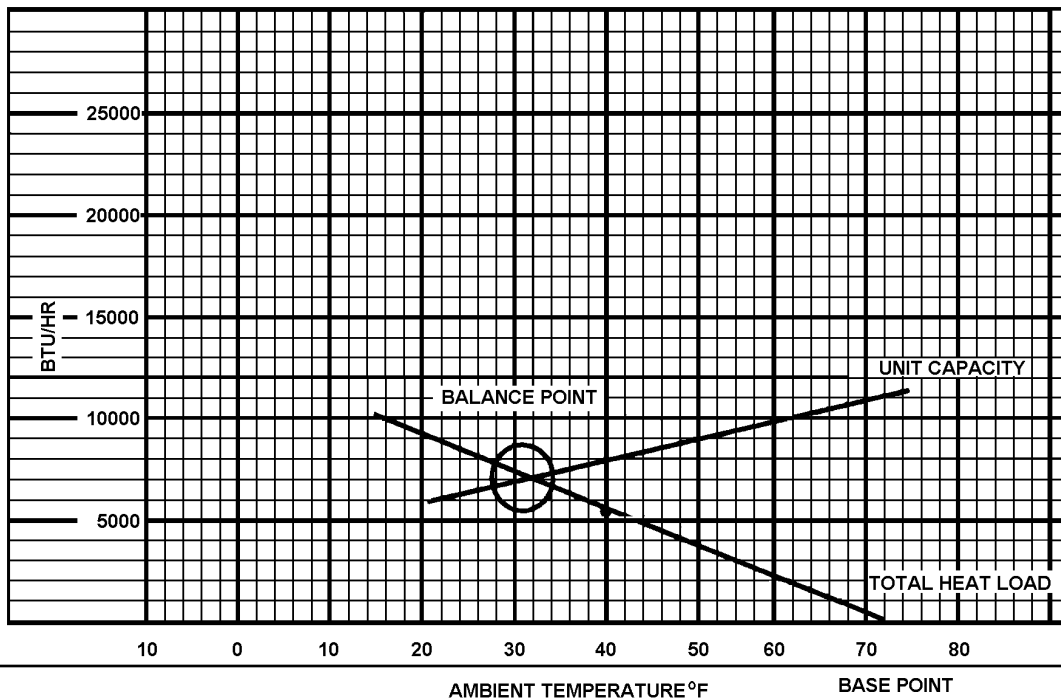
Knowing that we have a 5500 BTU/Hr. heat loss, and we expect that our heat pump will maintain a 70°F inside temperature at 40°F outdoor ambient, we plot the selected unit capacity BTU/Hr. of the unit between 35° and 60° on the graph and draw a straight line between these points. Where the total heat loss line and the unit capacity line intersect, read down to the outdoor ambient temperature scale and find that this unit will deliver the required BTU/Hr. capacity to approximately 30°F.

HEATING LOAD FORM

FRIEDRICH ROOM UNIT HEAT PUMPS

WALLS: (Linear Feet)	BTU/HR PER
2" Insulation	°F TEMP. DIFFERENCE
Average	Lin. Ft. x 1.6
	Lin. Ft. x 2.6
WINDOWS & DOORS (Area, sq. ft.)	
Single Glass:	Sq. Ft. x 1.13
Double Glass:	Sq. Ft. x 0.61
INFILTRATION - WINDOWS & DOORS: AVG.	Lin. Ft. x 1.0
Loose	Lin. Ft. x 2.0
CEILING: (Area, Sq. Ft.)	
Insulated (6")	Sq. Ft. x 0.07
Insulated (2")	Sq. Ft. x 0.10
Built-up Roof (2" insulated)	Sq. Ft. x 0.10
Built-up Roof (1/2" insulated)	Sq. Ft. x 0.20
No Insulation	Sq. Ft. x 0.33
FLOOR: (Area, Sq. Ft.)	
Above Vented Crawl space	
Insulated (1:)	Sq. Ft. x 0.20
Uninsulated	Sq. Ft. x 0.50
* Slab on Ground	Lin. Ft. x 1.70
1" Perimeter insulation	Lin. Ft. x 1.00
* Based on Linear Feet of outside wall	TOTAL HEAT LOSS PER °F BTU/HR/°F

Multiply total BTU/HR/°F X 30 and plot on the graph below at 40°F. Draw a straight line from the 70 base point thru the point plotted at 40°F. The intersection of this heat loss line with the unit capacity line represents the winter design heating load.



SPECIFICATIONS

			Electrical Characteristics (60 Hertz)									
Model	Cooling Capacity BTU/h	Heating Capacity BTU/h	Volts Rated	Cooling Amps	Cooling Watts	Heating Amos	Heating Watts	Energy Efficiency Ratio EER	Moisture Removal Pints/Hr.	Room Side Air Circulation CFM	Sleeve*	Net Weight Lbs.
XSTAR												
XQ05L10	5500	—	115	5.0	500	—	—	11.0	1.2	200	Q	70
XQ06L10	6300	—	115	4.9	548	—	—	11.5	1.4	175	Q	77
XQ08L10	8000	—	115	6.8	741	—	—	10.8	1.9	175	Q	80
XQ10L10	10000	—	115	9.0	1000	—	—	10.0	3.2	180	Q	76
XQ12L10	11700	—	115	11.0	1198	—	—	9.8	3.2	180	Q	76
QUIETMASTER Programmable												
SS08L10	8400	—	115	6.6	737	—	—	11.4	1.6	265	S	108
SS09L10	9100	—	115	7.2	791	—	—	11.5	1.8	265	S	113
SS10L10	10400	—	115	7.5	867	—	—	12.0	2.5	260	S	115
SS12L10	11800	—	115	9.0	1000	—	—	11.8	2.5	350	S	114
SS14L10	14000	—	115	12.0	1305	—	—	10.7	3.5	377	S	128
SS12L30	12100/11900	—	230/208	4.8/5.0	1052/1017	—	—	11.5/11.7	2.9	320	S	114
SS16L30	16200/15900	—	230/208	7.4/8.0	1653/1656	—	—	9.8/9.6	4.7	360	S	119
SM18L30	17800/17600	—	230/208	7.3/8.0	1618/1600	—	—	11.0/11.0	4.5	400	M	163
SM21L30	20600/20200	—	230/208	9.4/10.1	2081/2020	—	—	9.9/10.0	6.0	425	M	154
QUIETMASTER Deluxe												
RS10L10	10200	—	115	8.0	872	—	—	11.7	2.5	260	S	115
RS12L10	11800	—	115	9.0	1000	—	—	11.8	2.5	350	S	114
RS15L10	14500	—	115	12.2	1343	—	—	10.8	3.5	377	S	128
RS16L30	16200/15900	—	230/208	7.4/8.0	1653/1656	—	—	9.8/9.6	4.7	360	S	119
RM18L30	17800/17600	—	230/208	8.1/8.8	1780/1760	—	—	10.0/10.0	4.4	400	M	163
RM24L30	23500/23000	—	230/208	11.2/12.1	2479/2421	—	—	9.5/9.5	7.0	490	M	154
QUIETMASTER												
KS10L10	10000	—	115	8.0	870	—	—	11.5	2.5	260	S	115
KS12L10	11600	—	115	9.0	1055	—	—	11.0	2.1	356	S	114
KS15L10	14500	—	115	12.2	1343	—	—	10.8	3.5	377	S	128
KS12L30	12200/12000	—	230/208	5.4/5.8	1220/1176	—	—	10.0/10.2	3.5	325	S	106
KM18L30	17800/17600	—	230/208	8.1/8.8	1780/1760	—	—	10.0/10.0	4.4	400	M	161
KM21L30	20600/20200	—	230/208	9.4/10.1	2081/2020	—	—	9.9/10.0	6.0	425	M	154
KM24L30	23500/23000	—	230/208	11.2/12.1	2479/2421	—	—	9.5/9.5	7.0	490	M	154
QUIETMASTER Heavy Duty models												
SL25L30	24600/24400	—	230/208	11.5/12.6	2536/2515	—	—	9.7/9.7	6.8	560	L	181
SL28L30	28000/27700	—	230/208	13.0/14.2	2947/2916	—	—	9.5/9.5	8.8	600	L	201
SL36L30	36000/35700	—	230/208	18.0/19.6	3913/3880	—	—	9.2/9.2	11.0	725	L	220
CASEMENT												
SC06H10D	6200	—	115	6.7	713	—	—	8.7	2.0	140	SC	70
TWITEMP Heat Pump												
YQ07L10**	7200	6000	115	6.8	758	5.9	667	9.5	1.4	175	Q	78
YS09L10**	9200	7400	115	7.4	767	6.9	733	12.0	1.7	300	S	113
YS13L33	12700/12500	11000/10500	230/208	5.1/5.6	1149/1131	5.3/5.8	1185/1167	11.0/11.0	3.5	325	S	117
YM18L34	18000/18000	16800/16400	230/208	8.5/9.5	1895/1895	8.5/9.0	1867/1822	9.5/9.5	4.7	400	M	166
YL24L35	24000/24000	22000/21600	230/208	10.9/12.0	2400/2400	11.0/12.0	2444/2400	10.0/10.0	7.0	600	L	198
TWITEMP Electric Heat												
EQ08L11	7700	4000	115	6.5	733	11.2	1290	10.5	1.9	175	Q	76
ES12L33	12100/11900	10700/8900	230/208	4.8/5.0	1052/1017	16.0/14.7	3500/2900	11.5/11.7	2.9	320	S	111
ES16L33	16200/15900	10700/8900	230/208	7.4/8.0	1653/1656	16.0/14.7	3500/2900	9.8/9.6	4.7	360	S	116
EM18L34	17800/17600	13000/10600	230/208	8.1/8.8	1780/1760	19.5/17.0	4200/3500	10.0/10.0	4.4	400	M	160
EL25L35	24600/24400	17300/14300	230/208	11.5/12.6	2536/2515	24.0/22.4	5500/4650	9.7/9.7	6.8	560	L	180
EL36L35	36000/35700	17300/14300	230/208	18.0/19.6	3913/3880	24.0/22.4	5500/4650	9.2/9.2	11.0	725	L	220

* Sleeve dimensions listed on the following page. ** The YQ07 and YS09 models operate on 115 volts and are not equipped with supplemental heat. Both models will not provide heat at temperatures below 40° F. Friedrich room air conditioners are designed to operate in outdoor temperatures from 50° F to 115° F.

INSTALLATION INFORMATION / SLEEVE DIMENSIONS

Sleeve	Height	Width	Depth with Front	Depth Hood to Louvers	Minimum Extension Into Room	Minimum Extension Outside	Window Width		Thru-the-wall Finished Hole	
							Minimum	Maximum	Height	Width
Q	14"	19 3/4"	21 3/8"	8 1/2"	5 1/2"	10 3/4"	26"	42"	14 3/4"	20"
P1	12 9/32"	18 9/16"	14 31/32"	—	—	—	—	—	—	—
P2	12 9/32"	18 9/16"	14 9/16"	6"	4"	9"	22"	36"	—	—
P3	13 29/32"	20 3/32"	19 3/8"	—	—	—	—	—	—	—
P4	14 31/32"	23 5/8"	22 1/16"	—	—	—	—	—	—	—
S	15 15/16"	25 15/16"	27 3/8"	8 3/4"	3 1/16"	16 15/16"	27 7/8"	42"	16 3/16"	26 3/16"
M	17 15/16"	25 15/16"	27 3/8"	8 3/4"	3 1/16"	16 15/16"	27 7/8"	42"	18 3/16"	26 3/16"
L	20 3/16"	28"	33 5/8"	16 1/2"	3 3/16"	18 15/16"	29 7/8"	42"	20 3/8"	28 1/4"
SC	10 13/16"	14 11/16"	27"	9 7/8"	2 1/2"	15 1/2"	14 3/4"	17 7/8"	11 1/8"	14 15/16"
SV	20 1/2"	14 1/2"	23"	11"	5 1/4"	17 3/4"	15 1/2"	*	—	—

* SV fits windows a minimum of 21" H and a maximum of 40 1/2" H

CIRCUIT RATING/ BREAKER

Model	Circuit Rating Breaker or T-D Fuse	Plug Face (NEMA#)	Appearance (Facing Blades)
ALL SV, CP, XQ and ZQ MODELS, KS10L10, KS12L10, KS15L10, RS10L10, RS12L10, RS15L10, SS08L10, SS09L10, SS10L10, SS12L10, SS14L10, SC06H10D, EQ08L11, YQ07L10, YS09L10	125V - 15A	5 - 15P	
KS12L30, KM18L30, KM21L30, RS16L30, RM18L30, SS12L30, SS16L30, SM18L30, SM21L30	250V - 15A	6 - 15P	
KM24L30, RM24L30, SL25L30, SL28L30*, ES12L33, ES16L33, YS13L33	250V - 20A	6 - 20P	
SL36L30, EM18L34, EL25L35, EL36L35, YM18L34, YL24L35	250V - 30A	6 - 30P	

* Optional 30 Amp Kit (618-869-00) is recommended in 208 Volt power supply areas that fall below 208 Volts. For more information, call the Friedrich Service Department.

Wire Size	Use ONLY wiring size recommended for single outlet branch circuit.
Fuse/Circuit Breaker	Use ONLY type and size fuse or HACR circuit breaker indicated on unit's rating plate. Proper current protection to the unit is the responsibility of the owner.
Grounding	Unit MUST be grounded from branch circuit through service cord to unit, or through separate ground wire provided on permanently connected units. Be sure that branch circuit or general purpose outlet is grounded.
Receptacle	The field supplied outlet must match plug on service cord and be within reach of service cord. Do NOT alter the service cord or plug. Do NOT use an extension cord. Refer to the table above for proper receptacle and fuse type.



CAUTION

ELECTRIC SHOCK HAZARD.

Turn off electric power before service or installation.

All electrical connections and wiring **MUST** be installed by a qualified electrician and conform to the National Electrical Code and all local codes which have jurisdiction.

Failure to do so can result in property damage, personal injury and/or death.



The consumer - through the AHAM Room Air Conditioner Certification Program - can be certain that the AHAM Certification Seal accurately states the unit's cooling and heating capacity rating, the amperes and the energy efficiency ratio.



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PERFORMANCE DATA* Cooling	EVAPORATOR AIR TEMP. DEG. F		EVAPORATOR TEMP. DEG. F		CONDENSER TEMPERATURE DEG. F	Discharge Temp	Suction Temp	Liquid Temp	Super Heat	Sub-Cooling	OPERATING PRESSURES		ELECTRICAL RATINGS			R-22 REF.	Evap CFM	Motor RPM	BREAKER FUSE	
	Discharge Air	Temp. Drop F.	E(in)	E(out)							Suction	Discharge	Amps Cool	Amps Heat	Locked Rotor Amps					Charge in OZ.
Q-Chassis	XQ05L10-A	54	27	53	54	120	150	68	101	17	19	85	256	4.8	28.0	18.3	204	1080	15	
	XQ06L10-A	55	26	55	54	121	157	65	94	13	27	87	261	5.0	24.0	21.0	177	1080	15	
	XQ08L10-A	52	29	50	53	128	167	60	95	13	33	81	283	6.8	36.2	22.1	188	1080	15	
	XQ10L10-A	50	31	50	49	130	176	65	101	20	29	75	287	9.2	44.0	19.2	187	1080	15	
	XQ12L10-A	51	29	51	51	126	166	51	96	6	30	75	271	11.0	56.0	31.0	220	1400	15	
	EQ08L11-A	52	29	49	54	124	173	69	95	21	29	82	283	6.5	10.7	36.2	20.0	160	1080	15
	YQ07L10-A	55	25	52	58	126	177	73	103	26	23	79	275	6.8	5.6	19.5	323	1080	15	
	SS08L10-B	56	24	54	58	119	154	68	93	13	26	85	252	6.6		36.2	23.0	264	1070	15
	SS09L10-B	56	24	53	59	118	167	65	91	15	27	83	248	7.2		44.0	21.0	271	1070	15
	KS10L10-A	52	29	52	51	117	162	64	96	15	21	83	244	8.0		42.0	26.0	254	1070	15
S-Chassis	RS10L10-A	58	23	54	61	117	166	68	96	15	21	83	244	8.0		42.0	26.0	275	1070	15
	SS10L10-B	57	23	53	61	117	166	65	94	16	23	82	243	7.5		42.0	26.0	252	1070	15
	KS12L10-A	52	29	52	51	122	169	61	98	13	24	82	266	9.0		44.0	26.5	273	1070	15
	RS12L10-A	53	27	53	53	124	169	62	94	13	30	82	266	9.3		44.0	32.0	324	1070	15
	SS12L10-B	53	27	53	53	124	169	62	94	13	30	82	266	9.3		44.0	32.0	324	1100	15
	KS15L10-A	51	30	49	52	125	182	62	96	16	29	77	278	12.2		61.0	29.0	294	1070	15
	RS15L10-A	53	27	50	56	125	184	62	98	16	27	77	278	12.3		61.0	29.0	294	1070	15
	SS14L10-B	53	27	50	56	125	184	62	98	15	27	78	288	12.3		61.0	29.2	305	1070	15
	KS12L30-A	48	32	49	47	129	176	48	93	34	36	76	287	12.3		24.0	31.0	346	1100	15
	SS12L30-B	57	24	53	60	121	170	67	94	17	27	83	258	5.4		21.0	28.0	342	1100	15
M-Chassis	SH15L30-A	54	26	52	56	206	129	61	108	16	98	76	258	8.2		28.5	363	1100	15	
	SS16L30-B	50	31	50	49	130	176	53	95	8	35	77	279	7.9		35.0	32.1	244	1100	15
	RS16L30-A	50	31	50	49	130	176	53	95	8	35	77	279	7.4		35.0	32.0	244	1100	15
	ES12L33-A	56	25	54	57	121	167	65	93	15	28	83	256	4.8	15.1	21.0	28.0	325	1100	20
	ES16L33-A	49	32	50	47	130	179	50	96	8	34	75	279	7.4	15.1	35.0	32.0	360	1100	20
	YS09L10-A	60	20	57	63	116	164	71	99	18	17	89	239	7.1	8.5	44.0	25.1	309	1070	15
	YS09L10-B	60	20	57	63	116	164	71	99	18	17	89	239	7.1	8.5	44.0	25.1	309	1070	15
	YS09L10A-A	60	20	57	63	116	164	71	99	18	17	89	239	7.1	8.5	44.0	25.1	309	1070	15
	YS13L33-A	58	23	54	61	123	175	69	94	22	29	79	286	5.2	5.3 / 15.1	24.0	30.0	319	1100	20
	SH20L30-A	46	34	46	46	125	196	52	97	8	28	75	271	10.0		39.0	357	1100	15	
L-Chassis	KM24L30-A	50	31	48	51	132	187	56	95	14	37	70	287	11.2		68.0	53.0	478	1100	20
	YM18L34-A	50	31	48	51	132	187	56	95	14	37	70	287	11.2		68.0	53.0	478	1100	20
	RM24L30-A	49	31	48	50	125	182	64	98	22	27	72	271	8.5	8.7 / 18.6	41.0	43.0	396	1100	30
	RM18L30-A	49	31	48	50	125	175	63	94	21	31	72	271	8.7		42.0	39.5	396	1100	15
	EM18L34-A	49	31	48	50	125	175	63	94	21	31	72	271	8.1	18.9	42.0	39.5	396	1100	15
	KM18L30-A	49	31	48	50	125	175	63	94	21	31	72	271	8.1		42.0	39.5	396	1100	15
	SM18L30-A	53	28	52	53	122	175	66	97	13	25	82	255	7.3		37.0	44.0	396	1100	15
	KM21L30-A	50	31	49	50	127	185	57	93	15	34	73	274	9.4		43.0	45.0	413	1100	15
	SM21L30-A	50	31	49	50	127	185	57	93	15	34	73	274	9.4		43.0	45.0	413	1100	15
	SL25L30-A	50	30	48	52	126	172	56	93	12	33	75	255	14.1		68.0	53.0	530	1100	20
Casement	SL28L30-A	53	28	50	55	128	172	56	99	13	29	73	259	13.0		68.0	50.1	611	1100	20
	SL36L30-A	49	31	48	50	133	192	53	96	12	37	70	287	17.2		91.0	57.6	716	1100	30
	SL36L30-B	49	31	48	50	133	192	53	96	12	37	70	287	17.2		91.0	57.6	716	1100	30
	EL25L35-A	51	30	49	52	126	178	57	99	12	27	75	287	11.5	24.6	68.0	47.5	550	1100	30
	EL36L35-A	49	32	48	49	133	194	53	95	13	38	70	302	18.0	25.0	91.0	60.0	730	1100	30
	YL24L35-A	52	29	48	55	122	175	65	93	23	29	72	262	10.9	11.2 / 24.6	68.0	74.0	464	1100	30
SC08H10D	51	30	46	55	128	181	63	101	17	27	78	297	6.7		16.0	153	1600	15		

COMPONENTS: OPERATION & TESTING

WARNING

DISCONNECT ELECTRICAL POWER TO UNIT BEFORE SERVICING OR TESTING

COMPRESSORS

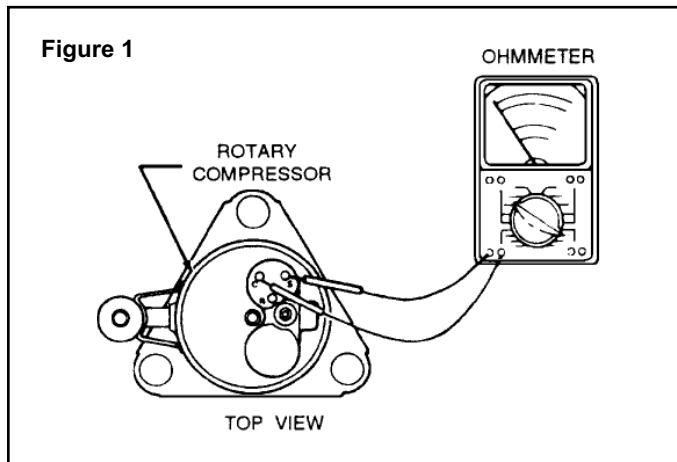
Compressors are single phase, 115 or 230/208 volt, depending on the model unit. All compressor motors are permanent split capacitor type using only a running capacitor across the start and run terminal.

All compressors are internally spring mounted and externally mounted on rubber isolators.

WINDING TEST

Remove compressor terminal box cover and disconnect wires from terminals. Using an ohmmeter, check continuity across the following: (See Figure 1)

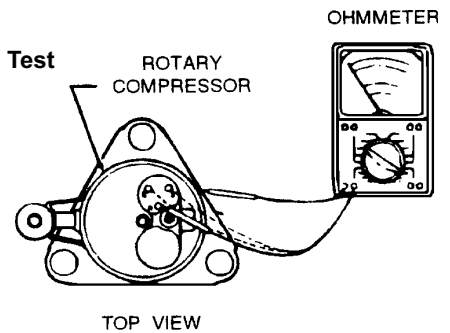
1. Terminal "C" and "S" - no continuity - open winding - replace compressor.
2. Terminal "C" and "R" - no continuity - open winding - replace compressor.
3. Terminal "R" and "S" - no continuity - open winding - replace compressor.



GROUND TEST

Use an ohmmeter set on its highest scale. Touch one lead to the compressor body (clean point of contact as a good connection is a must) and the other probe in turn to each compressor terminal (see Figure 2.) If a reading is obtained, the compressor is grounded and must be replaced.

Figure 2
Typical Ground Test



CHECKING COMPRESSOR EFFICIENCY

The reason for compressor inefficiency is normally due to broken or damaged suction and/or discharge valves, reducing the ability of the compressor to pump refrigerant gas.

This condition can be checked as follows:

1. Install a piercing valve on the suction and discharge or liquid process tube.
2. Attach gauges to the high and low sides of the system.
3. Start the system and run a "cooling or heating performance test."

If test shows:

- A. **Below** normal high side pressure
- B. **Above** normal low side pressure
- C. **Low** temperature difference across coil

The compressor valves are faulty - replace the compressor.

THERMAL OVERLOAD (External)

Some compressors are equipped with an external overload which is located in the compressor terminal box adjacent to the compressor body (See Figure 3.)

The overload is wired in series with the common motor terminal. The overload senses both major amperage and compressor temperature. High motor temperature or amperage heats the disc causing it to open and break the circuit to the common motor terminal.

Heat generated within the compressor shell is usually due to:

1. High amperage
2. Low refrigerant charge
3. Frequent recycling
4. Dirty condenser

TERMINAL OVERLOAD - TEST

(Compressor - External Type)

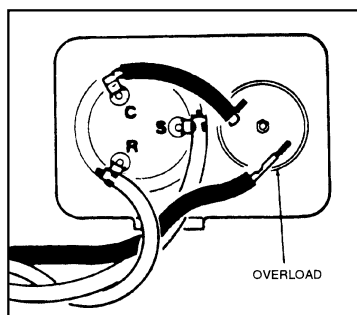
1. Remove overload.
2. Allow time for overload to reset before attempting to test.
3. Apply ohmmeter probes to terminals on overload wires. There should be continuity through the overload.

TERMINAL OVERLOAD (Internal)

Some model compressors are equipped with an internal overload. The overload is embedded in the motor windings to sense the winding temperature and/or current draw. The overload is connected in series with the common motor terminal.

Should the internal temperature and/or current draw become excessive, the contacts in the overload will open, turning off the compressor. The overload will automatically reset, but may require several hours before the heat is dissipated.

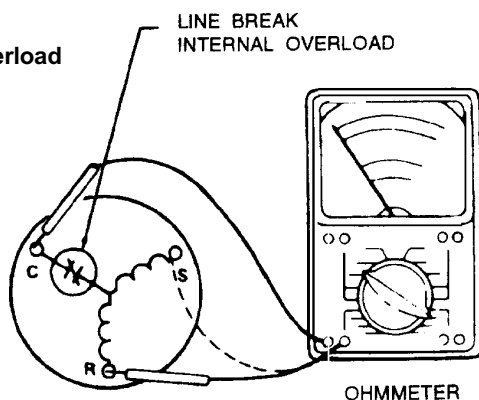
Figure 3- External Overload



CHECKING THE INTERNAL OVERLOAD

(See Figure 4)

Figure 4
Internal Overload



1. With no power to unit, remove the leads from the compressor terminals.
2. Using an ohmmeter, test continuity between terminals C-S and C-R. If no continuity, the compressor overload is open and the compressor must be replaced.

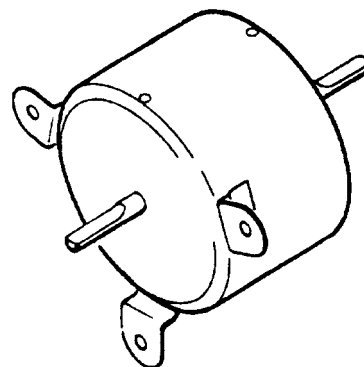
FAN MOTOR

A single phase permanent split capacitor motor is used to drive the evaporator blower and condenser fan. A self-resetting overload is located inside the motor to protect against high temperature and high amperage conditions. (See Figure 5)

FAN MOTOR - TEST

1. Determine that capacitor is serviceable.
2. Disconnect fan motor wires from fan speed switch or system switch.
3. Apply "live" test cord probes on black wire and common terminal of capacitor. Motor should run at high speed.
4. Apply "live" test cord probes on red wire and common terminal of capacitor. Motor should run at low speed.
5. Apply "live" test cord probes on each of the remaining wires from the speed switch or system switch to test intermediate speeds. If the control is in the "MoneySaver" mode and the thermostat calls for cooling, the fan will start - then stop after approximately 2 minutes; then the fan and compressor will start together approximately 2 minutes later.

Figure 5
Fan Motor

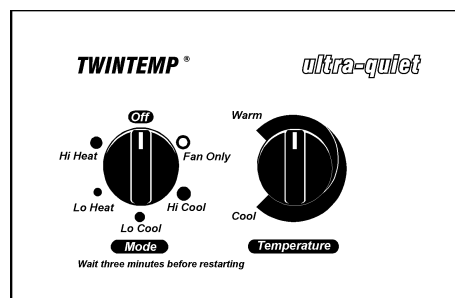


SYSTEM CONTROL PANEL

"EQ" and "YQ" Models (See Figure 6)

"EQ" and "YQ" models use a six-position control switch to regulate the operation of the unit.

Figure 6
System Control Panel ("EQ" and "YQ" Models)

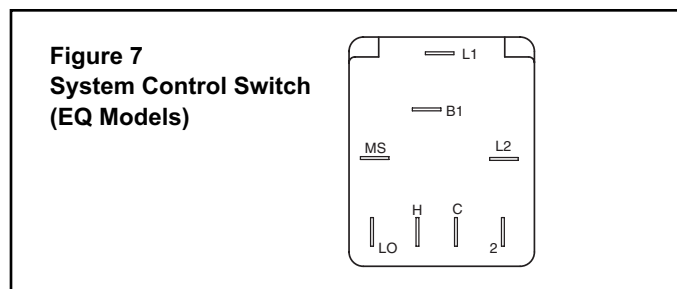


“EQ” SYSTEM CONTROL SWITCH – TEST

(See Figure 7)

Turn knob to phase of switch to be tested. There must be continuity as follows:

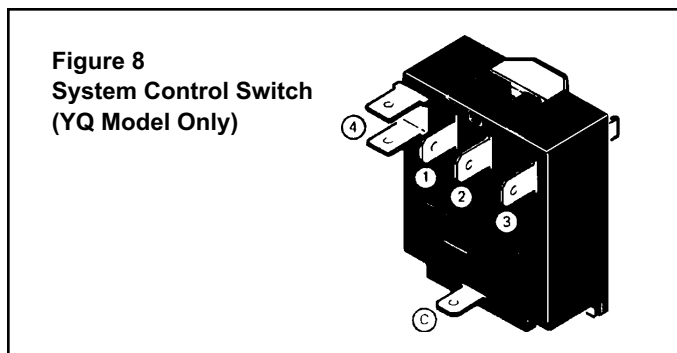
1. “Fan Only” Position – between terminals “MS” and “H”
2. “Hi Cool” Position – between terminals “L1” and “C” and “MS” and “H”
3. “Low Cool” Position – between terminals “L1” and “C” and “MS” and “LO”
4. “Low Heat” Position – between terminals “L2” and “2” and “MS” and “LO”
5. “Hi Heat” Position – between terminals “L2” and “2” and “MS” and “H”



“YQ” SYSTEM CONTROL SWITCH - TEST (See Figure 8)

Turn knob to phase of switch to be tested. There must be continuity as follows:

1. “Fan Only” Position - between terminals “C” and “1”.
2. “Hi Cool” Position - between terminals “C” and “1”, “C” and “3”.
3. “Lo Cool” Position - between terminals “C” and “2”, and “C” and “3”.
4. “Lo Heat” Position - between terminals “C” and “2”, and “C” and “4”.
5. “Hi Heat” Position - between terminals “C” and “1”, and “C” and “4”.

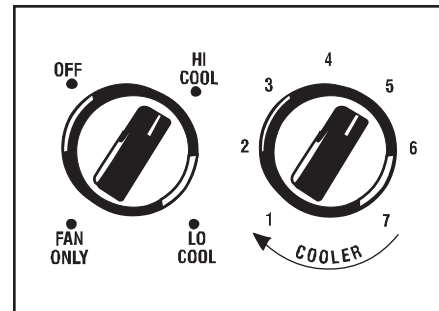


ROTARY (SYSTEM) SWITCH: “SC” Model

(See Figure 9)

A rotary four position switch is used to turn on the unit and select the operation desired.

Figure 9
System Control Panel (SC Model Only)

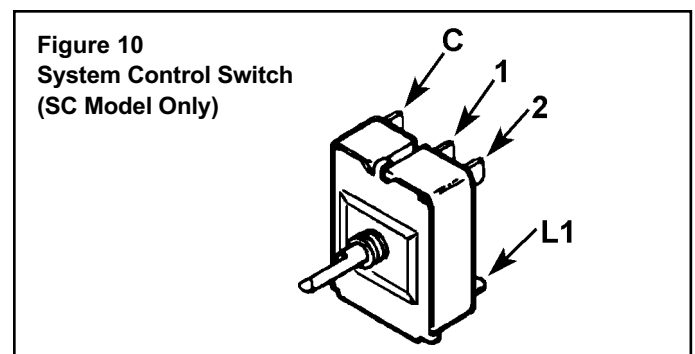


“SC” SYSTEM CONTROL SWITCH - TEST

(See Figure 10)

The switching arrangement of the control is as follows:

1. “Off” All contacts open.
2. “Hi Fan Contacts closed between terminals “L1” and “1”.
3. “Hi Cool” Contacts closed between terminals “L1” to “1” and “L1” and “C”.
4. “Lo-Cool” Contacts are closed between terminals “L1” to “2” and “L1” to “C”.



1. Disconnect leads from control switch.
2. Check continuity between all switch positions shown in Figure 11.

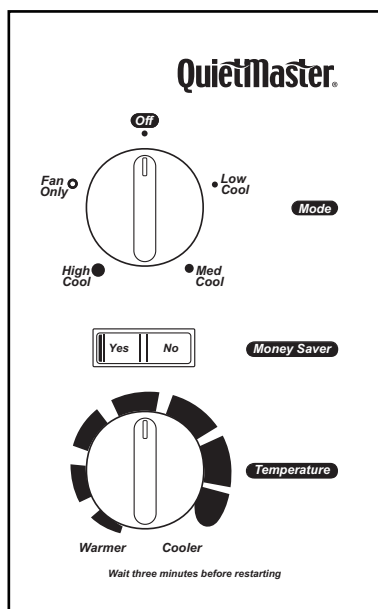
SYSTEM CONTROL SWITCH - KS, KM, SL Models

(See Figure 11)

A five position control switch is used to regulate the operation of the fan motor and compressor. The compressor can be operated with the fan operating at low, medium or high speed. The fan motor can also be operated independently on medium speed. See switch section as indicated on decorative control panel.

Figure 11

System Control Panel (KS, KM, SL)



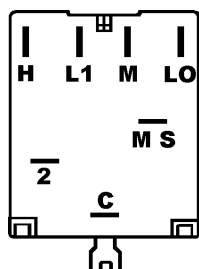
SYSTEM CONTROL SWITCH - TEST (See Figure 12)

Disconnect leads from control switch. There must be continuity as follows:

1. "Off" Position - no continuity between terminals.
2. "Lo Cool" Position - between terminals "L1" and "C," "LO" and "MS."
3. "Med Cool" Position - between terminals "L1" and "C," "M" and "MS."
4. "Hi Cool" Position - between terminals "L1" and "C," "H" and "MS."
5. "Fan Only" Position - between terminals "L1" and "2."

Figure 12

System Control Switch

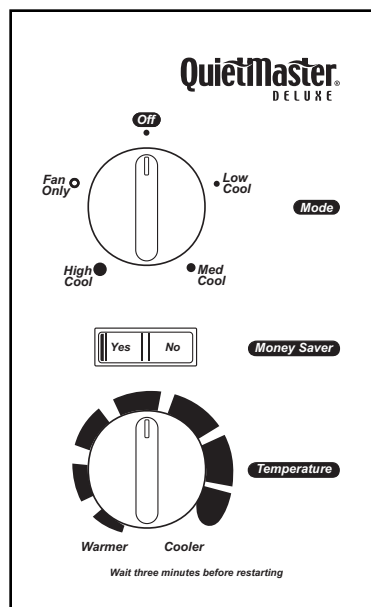


SYSTEM CONTROL PANEL (See Figure 13)

A six-position control switch is used to regulate the operation of the fan motor and compressor. The compressor can be operated with the fan operating at low, medium or high speed. The fan motor can also be operated independently on medium speed. See switch section as indicated on decorative control panel.

Figure 13

System Control Panel - Deluxe Series (RS & RM)



SYSTEM CONTROL SWITCH - TEST

Disconnect leads from control switch (See Figure 15)

There must be continuity as follows:

Figure 14

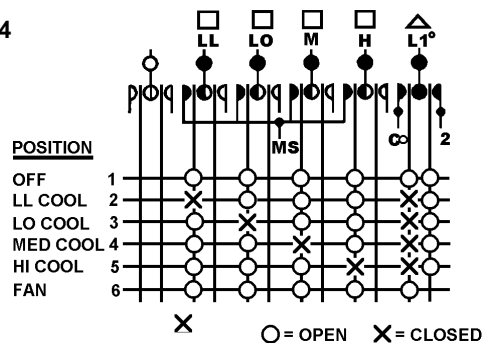
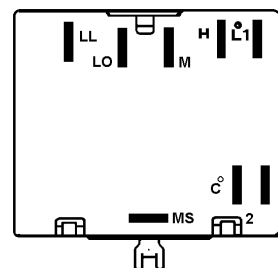


Figure 15

System Control Switch



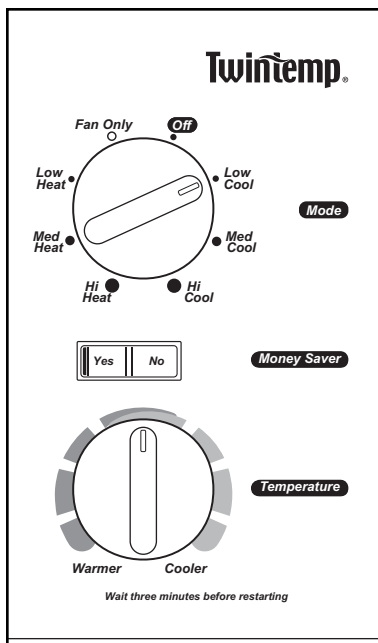
SYSTEM CONTROL PANEL

(Heat Pump & Electric Heat Models) (See Figure 16)

An eight position control switch is used to regulate the operation of the fan motor and compressor. The compressor can be operated with the fan operating at low, medium or high speed in the cooling or heating mode. The fan motor can also be operated independently on medium speed. See switch section as indicated on decorative control panel.

NOTE: Heat pump models with electric heat - in the heat position, heating element only will be energized when outdoor temperature is below the operating range of the heat pump.

Figure 16
System Control Panel
Heat Pump & Electric Heat Models
(YS, ES, YM, EM, YL & EL)



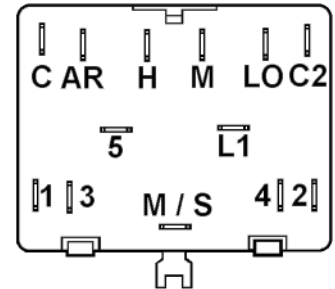
SYSTEM CONTROL SWITCH - TEST (See Figure 17)

Disconnect leads from control switch. Turn control to position being tested. There must be continuity as follows:

1. "Off" Position - no continuity between terminals.
2. "Lo Cool" Position - between terminals "C" and "3", "C2" and "2", "LO" and "M/S", "AR" and "5".
3. "Med Cool" Position - between terminals "C" and "3", "C2" and "2", "M" and "M/S", "AR" and "5".
4. "Hi Cool" Position - between terminals "C" and "3", "C2" and "2", "H" and "M/S", "AR" and "5".

5. "Hi Heat" Position - between terminals "C" and "1", "C2" and "4", "H" and "M/S", "AR" and "5".
6. "Med Heat" Position - between terminals "C" and "1", "C2" and "4", "M" and "M/S", "AR" and "5".
7. "Lo Cool" Position - between terminals "C" and "1", "C2" and "4", "LO" and "M/S", "AR" and "5".
8. "Fan Only" Position - between terminals "L1" and "M".

Figure 17
System Control Switch
(Heat Pump / Electric Heat Models)

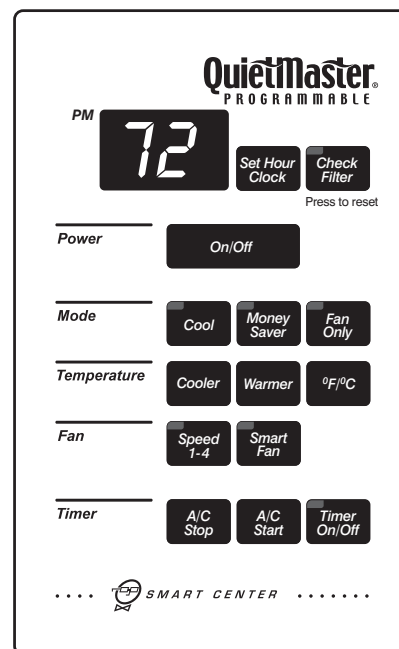


SMART CENTER ELECTRONIC CONTROL CENTER

(See Figure 18)

CHECK FILTER light will come on after 250 hours of use. Touch **CHECK FILTER** to reset.

Figure 18
Electronic Control



TESTING THE ELECTRONIC CONTROL

XQ/WS BOARDS & QME BOARDS

Checking Room Temperature:

1. Check the room temperature at the electronic control pad by pressing the **"FAN SPEED"** button and the temperature **"UP"** button at the same time on **XQ & WS models**.
2. Check the room temperature at the electronic control pad by pressing at the same time the **"FAN SPEED"** button and the **"WARMER"** button on **QME models**.

The indoor temperature will display for 10 seconds. Indoor temperature can be viewed in all modes, including the TEST mode. The display can be changed back to SET temperature by pressing any key, except the ON/OFF button, or after 10 seconds has elapsed.

Activating Test Mode: Activate test mode by pressing at the same time the **"MODE"** button and the temperature **"DOWN"** button on **XQ & WS models**. LEDs for Hour, Start, and Stop will blink 1 bps while Test Mode is active.

Activate test mode by pressing at the same time the **"MONEY SAVER"** button and the **"CHECK FILTER"** button on **QME models**. LED for the Filter Alert will blink 1 bps while Test Mode is active.

Test Mode has duration of 90 minutes. Test Mode can be activated under any conditions, including Off. Test Mode is cancelled by pressing the On/Off button, unplugging the unit, or when the 90 minutes is timed out. All settings revert to the factory default settings of Cool, 75 degrees F, Timer and Set Hour features are nonfunctional.

Test Mode overrides the three-minute lockout, all delays for compressor and fan motor start / speed change, and no delay when switching modes.

Test Mode default settings are ON, Money Saver, 60 degrees F, and High fan speed.

Activating Error Code Mode: (Submode of Test Mode) Unit must be in Test Mode to enter Error Code Mode

1. Activate Error Code Mode by pressing the **"TIMER ON/OFF"** button on XQ & WS models. LED for the **"TIMER ON/OFF"** will flash 1 bps while Error Code Mode is active. Pressing the **"TEMP/HR + "** button will display 00. Consecutive presses will scroll through all error codes logged. Press the **"TEMP/HR - "** button to see the reverse order of all error codes logged. When the end of logged error codes is reached the temperature set point will appear.

Activate Error Code Mode by pressing at the same time the **"A/C START"** button and the **"ON/OFF"** button on QME models. LED for the **"TIMER ON/OFF"** will flash 1 bps while Error Code Mode is active. Pressing the **"WARMER"** button will display 00. Consecutive presses will scroll through all error codes logged. Press the **"COOLER"** button to see the reverse order of all error codes logged. When the end of logged error codes is reached the temperature set point will appear.

IMPORTANT: Error Codes are cleared from the log by exiting from Error Code Mode. To exit on XQ & WS models, press Timer On/Off button. To exit QME models, press A/C Start and On/Off buttons. Or unplug unit to exit Error Code Mode. Plug unit in after 5 seconds to resume normal operation of unit.

TESTING THE ELECTRONIC CONTROL ERROR CODE LISTINGS

E1 SHORT CYCLE SITUATION: Defined as (compressor powered on before the three minute time delay ten times in one hour. Investigate and correct short cycling problem.

E2 KEYBOARD STUCK ERROR: If key button(s) are pressed continuously for twenty seconds or more. If MODE key is stuck, unit will default to cool. Exit Error Code Mode to see if error "E2" is no longer displayed and unit is functioning. Replace board if "E2" still displays after exiting Error Code Mode.

E3 FROST PROBE OPEN: Normal operation is allowed. Ohm frost probe. Replace probe if ohm value not read. If ohm value present replace board.

E4 FROST PROBE SHORT: Normal operation allowed. Replace probe.

E5 INDOOR PROBE OPEN: Control assumes indoor ambient temperature is 90 degree F and unit will operate. Ohm indoor probe. Replace probe if ohm value not read.

E6 INDOOR PROBE SHORT: Control assumes ambient temperature is 90 degree F and unit will operate. Replace probe.

NOTE: All Error Code displays for Frost & Indoor Probe will allow unit to operate. Unit may or will ice up if faulty components not replaced.

FROST PROBE SENSOR: disables compressor at 35 degrees F.

INDOOR PROBE SENSOR: Control range is 60 degrees F to 90 degrees F +/- 2 degrees F.

Indoor temperature will be displayed by pressing:

(QME units) The **Fan Speed** button and the **Warmer** button.

(XQ & WS units) The **Fan Speed** button and the **Temp Up** button.

The indoor temperature will be displayed for 10 seconds. The display will change back to the Set Point temperature by pressing any key button except for the On/Off button. The indoor temperature can be viewed in all modes, including test mode.

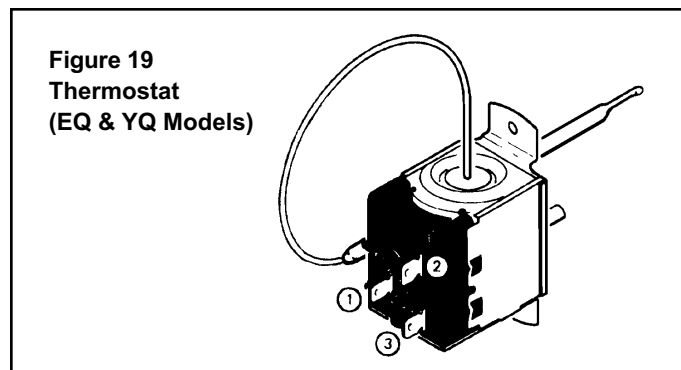
Check Filter: The **Check Filter** indicator turns on after the fan motor has been operating for 250 hours. The **Check Filter** indicator is reset by pressing the **Check Filter** button one time only. Power failures will not reset the 250 hour timer. All time elapsed is stored in memory and resumes counting after power is restored.

Keep Alive: The electronic control has a memory to retain all functions and status as set up by the user in the event of a power failure. Once power is restored to the unit there is a two second delay before the fan comes on and approximately three minutes delay before the compressor is activated, providing that the mode was set for cooling and the set point temperature has not been met in the room.

THERMOSTAT (“EQ” AND “YQ” Models)

(See Figure 19)

This thermostat is single pole-double throw, cross ambient with a range of 60° to 92°F and a differential of $\pm 2^\circ\text{F}$. Terminal “2” is common.



TEST:

1. Remove leads from thermostat.
2. Turn thermostat knob clockwise to its coldest position.
3. Test for continuity between the two terminals. Contacts should be closed.
4. Turn thermostat knob counterclockwise to its warmest position.
5. Test for continuity - contacts should be open.

NOTE: The thermostat must be within the temperature range listed to open and close.

To maintain the comfort level desired, a cross ambient type thermostat is used. The thermostat has a range from 60° $\pm 2^\circ\text{F}$ to 92° $\pm 3^\circ\text{F}$. The thermostat bulb is positioned in front of the evaporator coil to sense the return air temperature. Thermostat malfunction or erratic operation is covered in the troubleshooting section of this manual.

THERMOSTAT - Models ES, YS, EM, YM, EL, YL

(See Figure 20)

A cross ambient thermostat is used on all heat pump and electric heat units. In addition to cycling the unit in a heating or cooling operation, the thermostat will terminate the cooling cycle in the event ice forms on the evaporator coil, in this case the thermostat functions as a de-ice control. A resistor (anticipator) is positioned within a plastic block to supply a small amount of heat to the bulb area to prevent long “off cycles” in the “Cool-Fan Auto” (MoneySaver) position. A current feedback through the fan motor windings during “off cycle” completes the circuit to the resistor.

In the heating cycle, the heat anticipator is energized to supply a small amount of heat during the “on” cycle. This will open the contacts in the thermostat prematurely to maintain a closer differential between the “cut in” and “cut out” temperature. The heat anticipator is energized in the heating mode regardless of whether fan is placed in the automatic (MoneySaver) or constant run position.

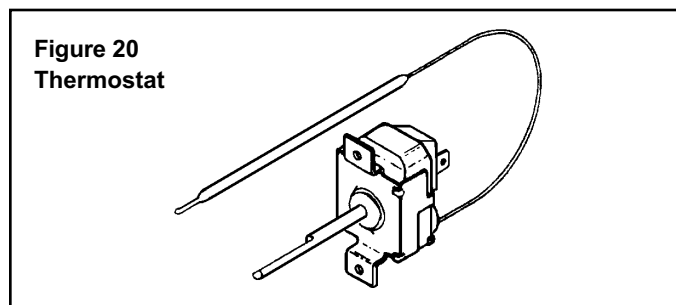
RANGE: Thermostat Properties
60°F ($\pm 2^\circ$) to 92°F ($\pm 2^\circ$),

TEST:

Cooling/Heating Models: Remove wires from thermostat and check continuity between terminal “2” (common) and “3” for cooling. Check between terminals “2” (common) and “1” for heating. Also check that contacts in thermostat open after placing in either position. NOTE: Temperature must be within range listed to check thermostat. Refer to the troubleshooting section in this manual for additional information on thermostat testing.

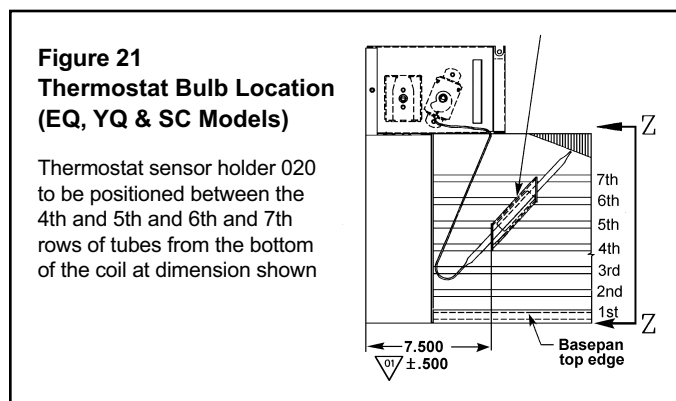
THERMOSTAT ADJUSTMENT

No attempt should be made to adjust thermostat. Due to the sensitivity of the internal mechanism and the sophisticated equipment required to check the calibration, it is suggested that the thermostat be replaced rather than calibrated. Thermostat bulb must be straight to insure proper performance.



THERMOSTAT BULB LOCATION

The position of the bulb is important in order for the thermostat to function properly. The bulb of the thermostat should be located approximately 45° to a maximum of 60° from horizontal. Also, do not allow the thermostat bulb to touch the evaporator coil. (See Figures 20 and 21)



DEFROST THERMOSTAT (Heat Pump Models Only)

(See Figure 22)

This thermostat is single pole - double throw with contacts between terminals "2" and "3" closing on temperature rise and contacts between terminals "2" and "1" closing on temperature fall. When the contacts between terminals "2" and "1" make, power is supplied to the heater element.

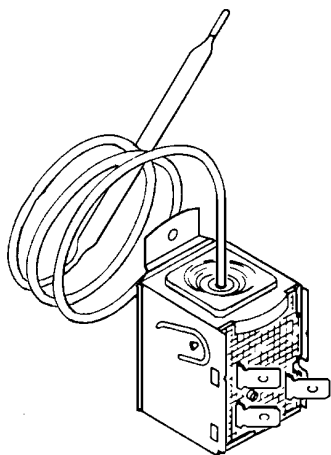
This control is dual purpose control that acts as an outdoor thermostat and defrost control.

When the sensing bulb, attached to the condenser coil, senses enough icing on the outdoor coil, it will interrupt power to the compressor and supply power to the heating element until the coil temperature reaches above 43°, then the heater will shut off and the unit will resume operating in the reverse cycle mode.

When the outdoor coil temperature drops below 20°, the unit will operate in electric heat mode continuously until the outdoor coil temperature rises above 43°.

The fan motor will not turn off when defrost occurs, and the 4-way valve will not reverse.

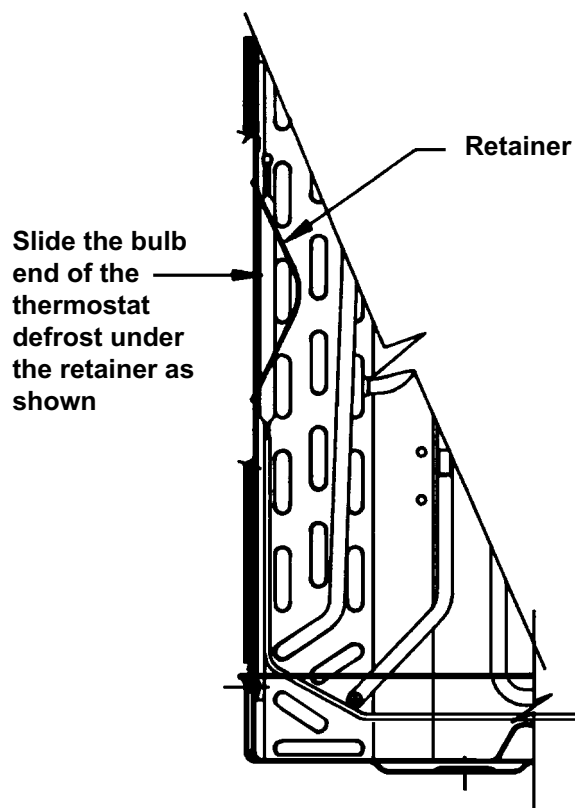
Figure 22
Defrost Thermostat
(Heat Pump Models)



DEFROST BULB LOCATION (Heat Pump Models Only) (See Figure 23)

The defrost control bulb must be mounted securely and in the correct location to operate properly.

Figure 23
Defrost Thermostat Bulb
Location (All Heat Pump Models)



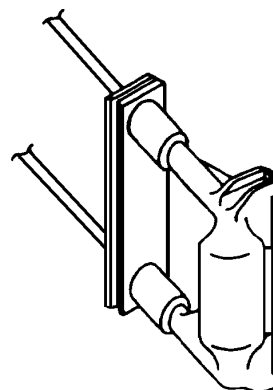
RESISTOR: Heat Anticipator (See Figure 24)

Failure of the resistor will cause prolonged "off" and "on" cycles of the unit. When replacing a resistor, be sure and use the exact replacement. Resistor ratings are as follows:

115 Volt - 5,000 ohms 3 watt

230 Volt - 20,000 ohms 3 watt

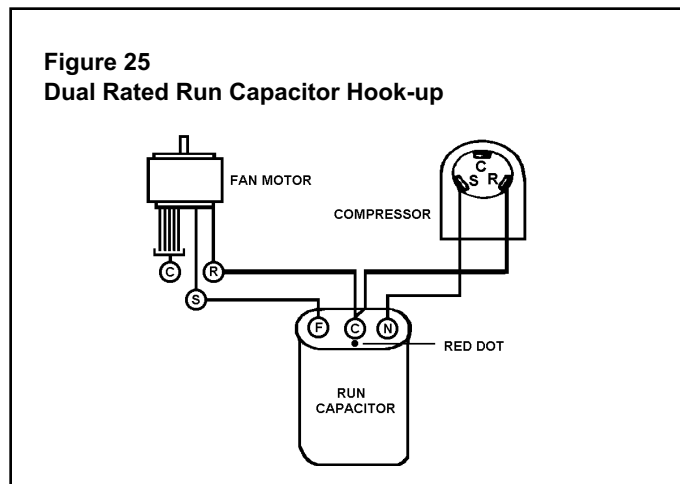
Figure 24
Resistor



CAPACITOR, RUN (See Figure 25)

A run capacitor is wired across the auxiliary and main winding of a single phase permanent split capacitor motor such as the compressor and fan motor. A single capacitor can be used for each motor or a dual rated capacitor can be used for both.

The capacitor's primary function is to reduce the line current while greatly improving the torque characteristics of a motor. The capacitor also reduces the line current to the motor by improving the power factor of the load. The line side of the capacitor is marked with a red dot and is wired to the line side of the circuit.



CAPACITOR - TEST

1. Remove capacitor from unit.
2. Check for visual damage such as bulges, cracks, or leaks.
3. For dual rated, apply an ohmmeter lead to common (C) terminal and the other probe to the compressor (HERM) terminal. A satisfactory capacitor will cause a deflection on the pointer, then gradually move back to infinity.
4. Reverse the leads of the probe and momentarily touch the capacitor terminals. The deflection of the pointer should be two times that of the first check if the capacitor is good.
5. Repeat steps 3 and 4 to check fan motor capacitor.

NOTE: A shorted capacitor will indicate a low resistance and the pointer will move to the "0" end of the scale and remain there as long as the probes are connected.

An open capacitor will show no movement of the pointer when placed across the terminals of the capacitor.

CHECK VALVE (See Figure 26)

A unique two-way check valve is used on the reverse cycle heat pumps. It is pressure operated and used to direct the flow of refrigerant through a single filter drier and to the proper capillary tube during either the heating or cooling cycle

Figure 26
One-way Check Valve
(Heat Pump Models)



NOTE: The slide (check) inside the valve is made of teflon. Should it become necessary to replace the check valve, place a wet cloth around the valve to prevent overheating during the brazing operation.

CHECK VALVE OPERATION

In the cooling mode of operation, high pressure liquid enters the check valve forcing the slide to close the opposite port (liquid line) to the indoor coil. Refer to refrigerant flow chart. This directs the refrigerant through the filter drier and cooling capillary tube to the indoor coil.

In the heating mode of operation, high pressure refrigerant enters the check valve from the opposite direction, closing the port (liquid line) to the outdoor coil. The flow path of the refrigerant is then through the filter drier and heating capillary to the outdoor coil.

Failure of the slide in the check valve to seat properly in either mode of operation will cause flooding of the cooling coil. This is due to the refrigerant bypassing the heating or cooling capillary tube and entering the liquid line.

COOLING MODE

In the cooling mode of operation, liquid refrigerant from condenser (liquid line) enters the cooling check valve forcing the heating check valve shut. The liquid refrigerant is directed into the liquid dryer after which the refrigerant is metered through cooling capillary tubes to evaporator. (Note: liquid refrigerant will also be directed through the heating capillary tubes in a continuous loop during the cooling mode).

HEATING MODE

In the heating mode of operation, liquid refrigerant from the indoor coil enters the heating check valve forcing the cooling check valve shut. The liquid refrigerant is directed into the liquid dryer after which the refrigerant is metered through the heating capillary tubes to outdoor coils. (Note: liquid refrigerant will also be directed through the cooling capillary tubes in a continuous loop during the heating mode).

HEAT PUMPS: REVERSING VALVE (See Figure 27)

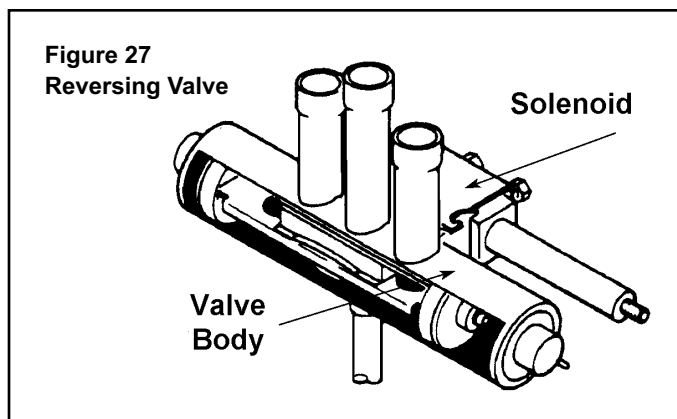
A reversing valve is used to change the refrigerant flow within the system to permit heating or cooling.

The reversing valve consists of a main valve body which houses the slide and piston, plus a pilot valve which is activated by a solenoid.

There are three tubes connected to one side of the main valve body and one tube on the opposite side. The single tube is connected to the compressor discharge line. The center tube on the opposite side is the common suction line to the compressor. The outside tubes are connected to the indoor and outdoor coils.

The pivot valve is responsible for directing the refrigerant flow to the indoor or outdoor coil. There are three small tubes connected to the pilot valve body. The center pilot tube is the common pilot tube and is connected to the center suction line. The outside tubes are connected to each end of the main valve body. The pilot valve consists of a needle valve and spring.

When the solenoid is de-energized, the spring tension closes one pilot port while the other remains open. When the solenoid is energized, the opposite end is closed. The piston in the main valve is pressure operated and will always travel in the direction of the open pilot tube port which provides a path to the center tube. Pressure which will increase in the opposite side of the valve will escape through a bleed port located in each piston. When de-energized, the valve will be in the cooling position.



TESTING REVERSING VALVE

Occasionally, the reversing valve may stick in the heating or cooling position or in the mid-position.

When stuck in the mid-position, part of the discharge gas from the compressor is directed back to the suction side, resulting in excessively high suction pressure.

Check the operation of the valve by starting the system and switching the operation from "Cooling" to "Heating" and then back to "Cooling". Do not hammer on valve.

If valve fails to change its position, test the voltage to the valve coil while the system is in the heating cycle. If voltage to coil is satisfactory, replace reversing valve.

Should the valve fail to shift from cooling to heating, block the air flow through the outdoor coil and allow the discharge pressure to build in the system. Then switch the system from heating to cooling.

If the valve is stuck in the heating position, block the air flow through the indoor coil and allow discharge pressure to build in the system. Then switch the system from heating to cooling.

Should the valve fail to shift in either position after increasing the discharge pressure, replace the valve.

NOTE: When brazing a reversing valve into the system, it is of extreme importance that the temperature of the valve does not exceed 250° F at any time.

Wrap the reversing valve with a large rag saturated with water. "Re-wet" the rag and thoroughly cool the valve after each brazing operation of the four joints involved.

The wet rag around the reversing valve will eliminate conduction of heat to the valve body when brazing the line connection.

SOLENOID COIL (Heat Pump Models Only)

(See Figure 27)

The solenoid coil is an electromagnetic type coil mounted on the reversing valve and is energized during the operation of the compressor in the heating cycle.

Should the reversing valve fail to shift during the heating cycle, test the solenoid coil.

TO TEST:

1. Disconnect power to unit.
2. Disconnect coil leads.
3. Attach probes of an ohmmeter to each coil lead and check for continuity.

NOTE: Do not start unit with solenoid coil removed from valve, or do not remove coil after unit is in operation. This will cause the coil to burn out.

VALVE, DRAIN PAN (See Figure 28)

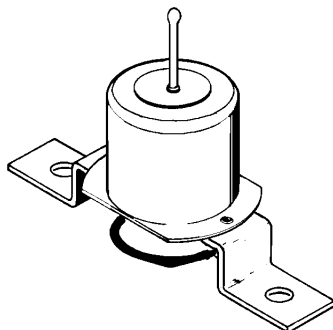
During the cooling mode of operation, condensate which collects in the drain pan is picked up by the condenser fan blade and sprayed onto the condenser coil. This assists in cooling the refrigerant plus evaporating the water.

During the heating mode of operation, it is necessary that water be removed to prevent it from freezing during cold outside temperatures. This could cause the condenser fan blade to freeze in the accumulated water and prevent it from turning.

To provide a means of draining this water, a bellows type drain valve is installed over a drain opening in the base pan.

This valve is temperature sensitive and will open when the outside temperature reaches 40°F. The valve will close gradually as the temperature rises above 40°F to fully close at 60°F.

Figure 28
Bellows Assembly
Drain Pan Valve



HEATING ELEMENT (See Figure 29)

All heat pumps and electric heat models are equipped with a heating element with the exception of models starting with YS09 and YQ07. The “YS” and “ES” models are equipped with a 3.3 KW element. The “YM” and “EM” models are equipped with a 4.0 KW element. The “YL” and “EL” models are equipped with a 5.2 KW element.

The heating element contains a fuse link and a heater limit switch. The fuse link is in series with the power supply and will open and interrupt the power when the temperature reaches 161.6°F, or a short circuit occurs in the heating element. Once the fuse link separates, a new fuse link must be installed.

NOTE: Always replace with the exact replacement.

The heater element has a high limit control. This control is a bimetal thermostat mounted in the top of the heating element.

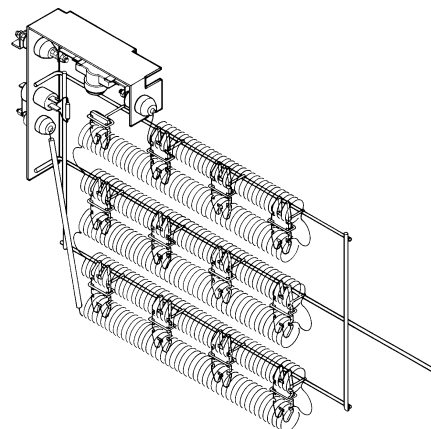
Should the fan motor fail or filter become clogged, the high limit control will open and interrupt power to the heater before reaching an unsafe temperature condition.

The control is designed to open at 110°F ±6°F. Test continuity below 110°F and for open above 110°F.

The heating element for the “Y” model is energized by an outdoor thermostat. The outdoor thermostat is adjusted at a predetermined temperature to bring on the heating element and turn off the compressor. The room thermostat will then control the cycling of the element when the selected indoor temperature is reached.

Testing of the elements can be made with an ohmmeter across the terminals after the connecting wires have been removed. A cold resistance reading of approximately 14.5 ohms for the 3.3 KW heater, 11.9 ohms for the 4.0 KW heater and 9.15 ohms for the 5.2 KW heater should be registered.

Figure 29 - Heating Element



REFRIGERATION SYSTEM SEQUENCE OF OPERATION

A good understanding of the basic operation of the refrigeration system is essential for the service technician. Without this understanding, accurate troubleshooting of refrigeration system problems will be more difficult and time consuming, if not (in some cases) entirely impossible. The refrigeration system uses four basic principles (laws) in its operation they are as follows:

1. “Heat always flows from a warmer body to a cooler body.”
2. “Heat must be added to or removed from a substance before a change in state can occur”
3. “Flow is always from a higher pressure area to a lower pressure area.”
4. “The temperature at which a liquid or gas changes state is dependent upon the pressure.”

The refrigeration cycle begins at the compressor. Starting the compressor creates a low pressure in the suction line which draws refrigerant gas (vapor) into the compressor. The compressor then “compresses” this refrigerant, raising its pressure and its (heat intensity) Temperature.

The refrigerant leaves the compressor through the discharge line as a hot high pressure gas (vapor). The refrigerant enters the condenser coil where it gives up some of its heat. The condenser fan moving air across the coil's finned surface facilitates the transfer of heat from the refrigerant to the relatively cooler outdoor air.

When a sufficient quantity of heat has been removed from the refrigerant gas (vapor), the refrigerant will “condense” (i.e. change to a liquid). Once the refrigerant has been condensed (changed) to a liquid it is cooled even further by the air that continues to flow across the condenser coil.

The RAC design determines at exactly what point (in the condenser) the change of state (i.e. gas to a liquid) takes place. In all cases, however, the refrigerant must be totally condensed (changed) to a liquid before leaving the condenser coil.

The refrigerant leaves the condenser coil through the liquid line as a warm high pressure liquid. It next will pass through the refrigerant drier (if so equipped). It is the function of the drier to trap any moisture present in the system, contaminants, and large particulate matter.

The liquid refrigerant next enters the metering device. The metering device is a capillary tube. The purpose of the metering device is to "meter" (i.e. control or measure) the quantity of refrigerant entering the evaporator coil.

In the case of the capillary tube this is accomplished (by design) through size (and length) of device, and the pressure difference present across the device.

Since the evaporator coil is under a lower pressure (due to the suction created by the compressor) than the liquid line, the liquid refrigerant leaves the metering device entering the evaporator coil. As it enters the evaporator coil, the larger area and lower pressure allows the refrigerant to expand and lower its temperature (heat intensity). This expansion is often referred to as "boiling". Since the unit's blower is moving Indoor air across the finned surface of the evaporator coil, the expanding refrigerant absorbs some of that heat. This results in a lowering of the indoor air temperature, hence the "cooling" effect.

The expansion and absorbing of heat cause the liquid refrigerant to evaporate (i.e. change to a gas). Once the refrigerant has been evaporated (changed to a gas), it is heated even further by the air that continues to flow across the evaporator coil.

The particular system design determines at exactly what point (in the evaporator) the change of state (i.e. liquid to a

gas) takes place. In all cases, however, the refrigerant must be totally evaporated (changed) to a gas before leaving the evaporator coil.

The low pressure (suction) created by the compressor causes the refrigerant to leave the evaporator through the suction line as a cool low pressure vapor. The refrigerant then returns to the compressor, where the cycle is repeated.

SEALED REFRIGERATION SYSTEM REPAIRS

IMPORTANT

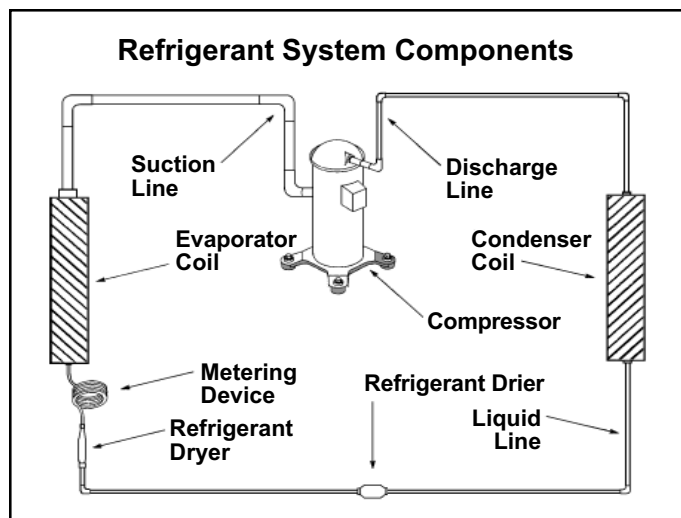
ANY SEALED SYSTEM REPAIRS TO COOL-ONLY MODELS REQUIRE THE INSTALLATION OF A LIQUID LINE DRIER. ALSO, ANY SEALED SYSTEM REPAIRS TO HEAT PUMP MODELS REQUIRE THE INSTALLATION OF A SUCTION LINE DRIER.

EQUIPMENT REQUIRED

1. Voltmeter
2. Ammeter
3. Ohmmeter
4. E.P.A. Approved Refrigerant Recovery System.
5. Vacuum Pump (capable of 200 microns or less vacuum.)
6. Acetylene Welder
7. Electronic Halogen Leak Detector (G.E. Type H-6 or equivalent.)
8. Accurate refrigerant charge measuring device such as:
 - a. Balance Scales - 1/2 oz. accuracy
 - b. Charging Board - 1/2 oz. accuracy
9. High Pressure Gauge - (0 - 400 lbs.)
10. Low Pressure Gauge - (30 - 150 lbs.)
11. Vacuum Gauge - (0 - 1000 microns)

EQUIPMENT MUST BE CAPABLE OF:

1. Recovery CFC's as low as 5%.
2. Evacuation from both the high side and low side of the system simultaneously.
3. Introducing refrigerant charge into high side of the system.
4. Accurately weighing the refrigerant charge actually introduced into the system.
5. Facilities for flowing nitrogen through refrigeration tubing during all brazing processes.



HERMETIC COMPONENT REPLACEMENT

The following procedure applies when replacing components in the sealed refrigeration circuit or repairing refrigerant leaks. (Compressor, condenser, evaporator, capillary tube, refrigerant leaks, etc.)

1. Recover the refrigerant from the system at the process tube located on the high side of the system by installing a line tap on the process tube. Apply gauge from process tube to EPA approved gauges from process tube to EPA approved recovery system. Recover CFC's in system to at least 5%.
2. Cut the process tube below pinch off on the suction side of the compressor.
3. Connect the line from the nitrogen tank to the suction process tube.
4. Drift dry nitrogen through the system and un-solder the more distant connection first. (Filter drier, high side process tube, etc.)
5. Replace inoperative component, and always install a new filter drier. Drift dry nitrogen through the system when making these connections.
6. Pressurize system to 30 PSIG with proper refrigerant and boost refrigerant pressure to 150 PSIG with dry nitrogen.
7. Leak test complete system with electric halogen leak detector, correcting any leaks found.
8. Reduce the system to zero gauge pressure.
9. Connect vacuum pump to high side and low side of system with deep vacuum hoses, or copper tubing. (Do not use regular hoses.)
10. Evacuate system to maximum absolute holding pressure of 200 microns or less. NOTE: This process can be accelerated by use of heat lamps, or by breaking the vacuum with refrigerant or dry nitrogen at 5,000 microns. Pressure system to 5 PSIG and leave in system a minimum of 10 minutes. Release refrigerant, and proceed with evacuation of a pressure of 200 microns or less.

11. Break vacuum by charging system from the high side with the correct amount of liquid refrigerant specified. This will prevent boiling the oil out of the crankcase, and damage to the compressor due to over heating.

NOTE: If the entire charge will not enter the high side, allow the remainder to enter the low side in small increments while operating the unit.

12. Restart unit several times after allowing pressures to stabilize. Pinch off process tubes, cut and solder the ends. Remove pinch off tool, and leak check the process tube ends.

SPECIAL PROCEDURE IN THE CASE OF COMPRESSOR MOTOR BURNOUT

1. Recover all refrigerant and oil from the system.
2. Remove compressor, capillary tube and filter drier from the system.
3. Flush evaporator condenser and all connecting tubing with dry nitrogen or equivalent, to remove all contamination from system. Inspect suction and discharge line for carbon deposits. Remove and clean if necessary.
4. Reassemble the system, including new drier strainer and capillary tube.
5. Proceed with processing as outlined under hermetic component replacement.

ROTARY COMPRESSOR SPECIAL TROUBLESHOOTING AND SERVICE

Basically, troubleshooting and servicing rotary compressors is the same as on the reciprocating compressor with only one main exception:

NEVER, under any circumstances, charge a rotary compressor through the LOW side. Doing so would cause permanent damage to the new compressor.

REFRIGERANT CHARGING

NOTE: BECAUSE THE RAC SYSTEM IS A SEALED SYSTEM, SERVICE PROCESS TUBES WILL HAVE TO BE INSTALLED. FIRST INSTALL A LINE TAP AND REMOVE REFRIGERANT FROM SYSTEM. MAKE NECESSARY SEALED SYSTEM REPAIRS AND VACUUM SYSTEM. CRIMP PROCESS TUBE LINE AND SOLDER END SHUT. DO NOT LEAVE A SERVICE VALVE IN THE SEALED SYSTEM.

Proper refrigerant charge is essential to proper unit operation. Operating a unit with an improper refrigerant charge will result in reduced performance (capacity) and/or efficiency. Accordingly, the use of proper charging methods during servicing will insure that the unit is functioning as designed and that its compressor will not be damaged.

Too much refrigerant (overcharge) in the system is just as bad (if not worse) than not enough refrigerant (undercharge). They both can be the source of certain compressor failures if they remain uncorrected for any period of time. Quite often, other problems (such as low air flow across evaporator, etc.) are misdiagnosed as refrigerant charge problems. The refrigerant circuit diagnosis chart will assist you in properly diagnosing these systems.

An overcharged unit will at times return liquid refrigerant (slugging) back to the suction side of the compressor eventually causing a mechanical failure within the compressor. This mechanical failure can manifest itself as valve failure, bearing failure, and/or other mechanical failure. The specific type of failure will be influenced by the amount of liquid being returned, and the length of time the slugging continues.

Not enough refrigerant (Undercharge) on the other hand, will cause the temperature of the suction gas to increase to the point where it does not provide sufficient cooling for

the compressor motor. When this occurs, the motor winding temperature will increase causing the motor to overheat and possibly cycle open the compressor overload protector. Continued overheating of the motor windings and/or cycling of the overload will eventually lead to compressor motor or overload failure.

METHOD OF CHARGING

The acceptable method for charging the RAC system is the Weighed in Charge Method. The weighed in charge method is applicable to all units. It is the preferred method to use, as it is the most accurate.

The weighed in method should always be used whenever a charge is removed from a unit such as for a leak repair, compressor replacement, or when there is no refrigerant charge left in the unit. To charge by this method, requires the following steps:

1. Install a piercing valve to remove refrigerant from the sealed system. (Piercing valve must be removed from the system before recharging.)
2. Recover Refrigerant in accordance with EPA regulations.
3. Install a process tube to sealed system.
4. Make necessary repairs to system.
5. Evacuate system to 250 - 300 microns or less.
6. Weigh in refrigerant with the property quantity of R-22 refrigerant.
7. Start unit, and verify performance.
8. Crimp the process tube and solder the end shut.

NOTE: In order to access the sealed system it will be necessary to install Schrader type fittings to the process tubes on the discharge and suction of the compressor. Proper refrigerant recovery procedures need to be adhered to as outlined in EPA Regulations. THIS SHOULD ONLY BE ATTEMPTED BY QUALIFIED SERVICE PERSONNEL.

UNDERCHARGED REFRIGERANT SYSTEMS

An undercharged system will result in poor performance (low pressures, etc.) in both the heating and cooling cycle.

Whenever you service a unit with an undercharge of refrigerant, always suspect a leak. The leak must be repaired before charging the unit.

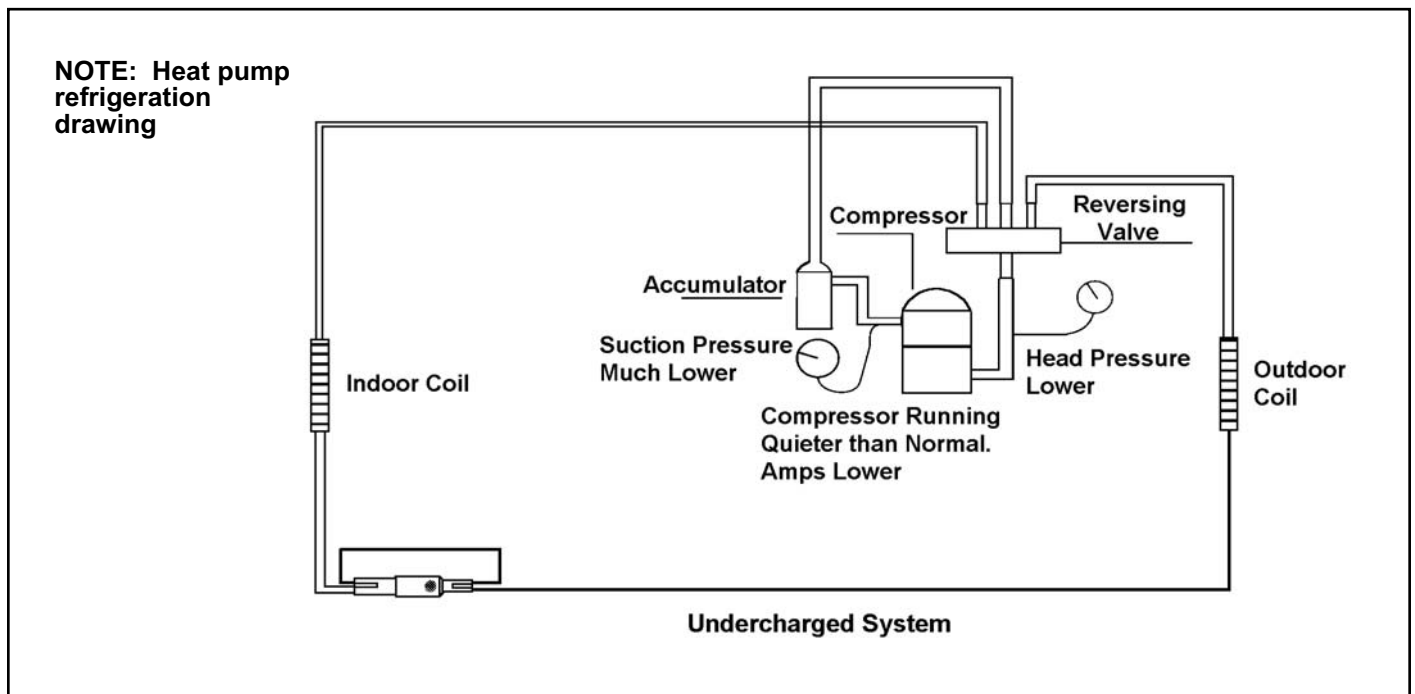
To check for an undercharged system, turn the unit on, allow the compressor to run long enough to establish working pressures in the system (15 to 20 minutes).

During the cooling cycle you can listen carefully at the exit of the metering device into the evaporator; an intermittent hissing and gurgling sound indicates a low refrigerant charge.

Intermittent frosting and thawing of the evaporator is another indication of a low charge, however, frosting and thawing can also be caused by insufficient air over the evaporator.

Checks for an undercharged system can be made at the compressor. If the compressor seems quieter than normal, it is an indication of a low refrigerant charge. A check of the amperage drawn by the compressor motor should show a lower reading. (Check the Unit Specification.) After the unit has run 10 to 15 minutes, check the gauge pressures.

Gauges connected to system with an undercharge will have low head pressures and substantially low suction pressures.



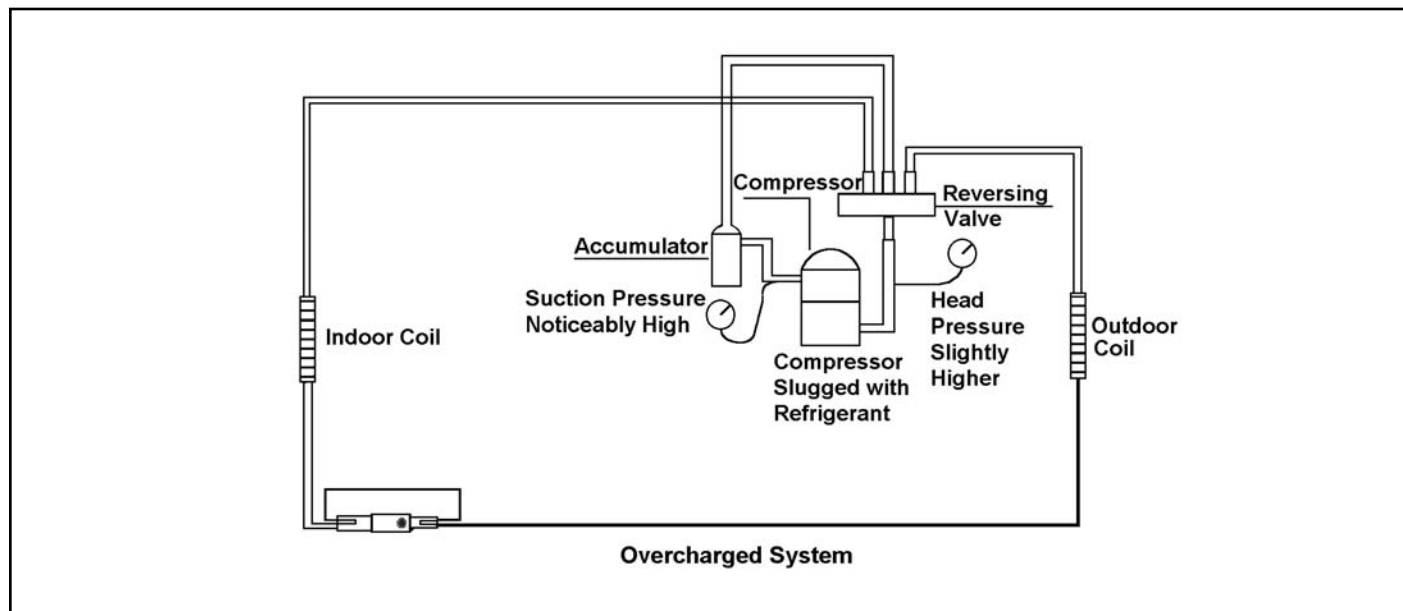
OVERCHARGED REFRIGERANT SYSTEMS

Compressor amps will be near normal or higher. Noncondensables can also cause these symptoms. To confirm, remove some of the charge, if conditions improve, system may be overcharged. If conditions don't improve, Noncondensables are indicated.

Whenever an overcharged system is indicated, always make sure that the problem is not caused by air flow problems. Improper air flow over the evaporator coil may indicate some of the same symptoms as an overcharged system.

An over charge can cause the compressor to fail, since it would be "slugged" with liquid refrigerant.

The charge for any system is critical. When the compressor is noisy, suspect an overcharge, when you are sure that the air quantity over the evaporator coil is correct. Icing of the evaporator will not be encountered because the refrigerant will boil later if at all. Gauges connected to system will usually have higher head pressure (depending upon amount of overcharge). Suction pressure should be slightly higher.



RESTRICTED REFRIGERANT SYSTEM

A quick check for either condition begins at the evaporator. With a partial restriction, there may be gurgling sounds at the metering device entrance to the evaporator. The evaporator in a partial restriction could be partially frosted or have an ice ball close to the entrance of the metering device. Frost may continue on the suction line back to the compressor.

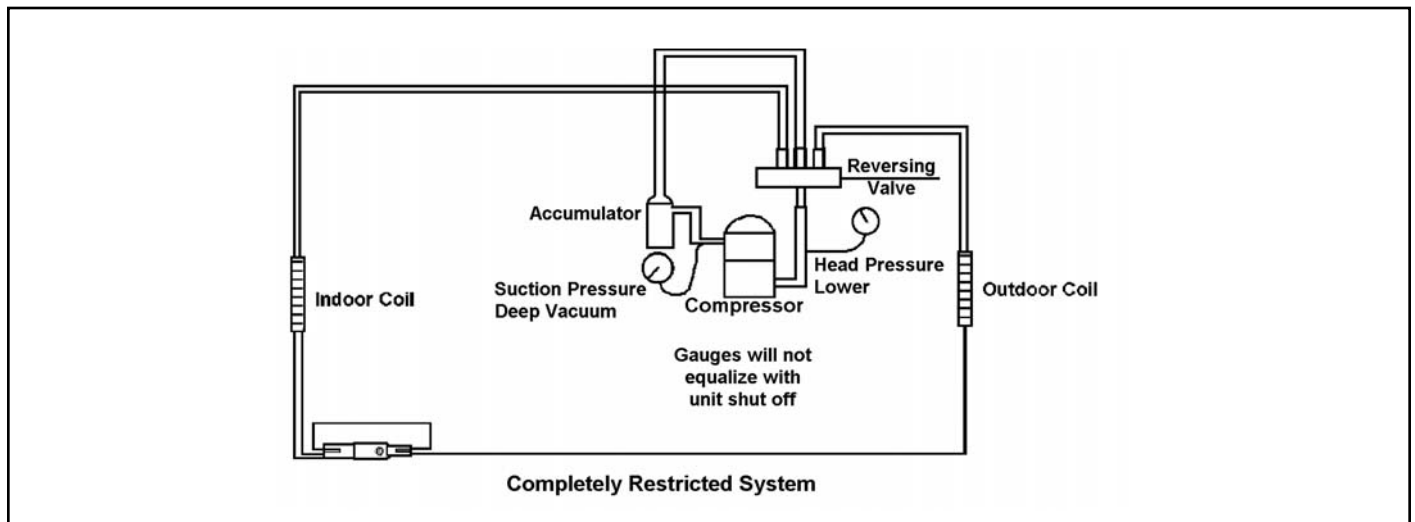
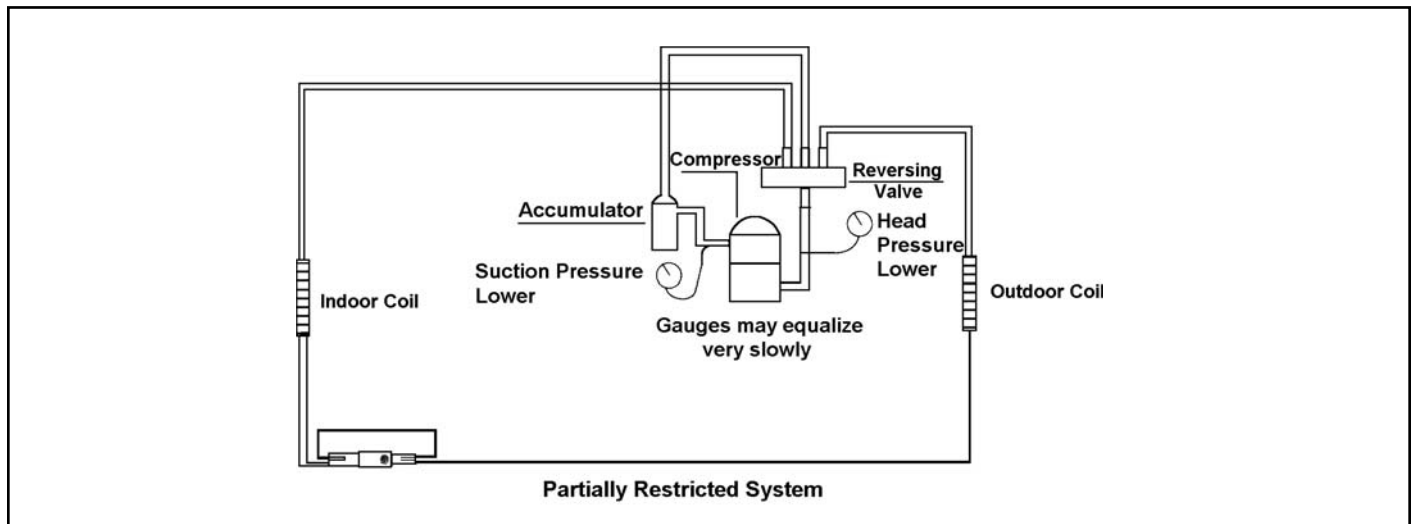
Often a partial restriction of any type can be found by feel, as there is a temperature difference from one side of the restriction to the other.

With a complete restriction, there will be no sound at the metering device entrance. An amperage check of the compressor with a partial restriction may show normal current when compared to the unit specification. With a complete restriction the current drawn may be considerably less than normal, as the compressor is running in a deep vacuum (no load.) Much of the area of the condenser will be relatively cool since most or all of the liquid refrigerant will be stored there.

The following conditions are based primarily on a system in the cooling mode.

Troubleshooting a restricted refrigerant system can be difficult. The following procedures are the more common problems and solutions to these problems. There are two types of refrigerant restrictions: Partial restrictions and complete restrictions.

- A partial restriction allows some of the refrigerant to circulate through the system.
- With a complete restriction there is no circulation of refrigerant in the system.
- Restricted refrigerant systems display the same symptoms as a “low-charge condition.”
- When the unit is shut off, the gauges may equalize very slowly.
- Gauges connected to a completely restricted system will run in a deep vacuum. When the unit is shut off, the gauges will not equalize at all.



ROUTINE MAINTENANCE

NOTE: Units are to be inspected and serviced by qualified service personnel only.

Routine maintenance is required annually or semi-annually, depending upon annual usage.

1. Clean the unit air intake filter at least every 250 to 300 fan hours of operation or when the unit's indicator light is on if so equipped. Clean the filters with a mild detergent in warm water and allow to dry thoroughly before reinstalling.
2. The indoor coil (evaporator coil), the outdoor coil (condenser coil) and base pan should be inspected periodically (yearly or bi-yearly) and cleaned of all debris (lint, dirt, leaves, paper, etc.). Clean the coils and base pan with a soft brush and compressed air or vacuum. If using a pressure washer, be careful not to bend the aluminium fin pack. Use a sweeping up and down motion in the direction of the vertical aluminum fin pack when pressure cleaning coils. Cover all electrical components to protect them from water or spray. Allow the unit to dry thoroughly before reinstalling it in the sleeve.

NOTE: Do not use a caustic coil cleaning agent on coils or base pan. Use a biodegradable cleaning agent and degreaser.

Inspect the indoor blower housing, evaporator blade, condenser fan blade, and condenser shroud periodically (yearly or bi-yearly) and clean of all debris (lint, dirt, mold, fungus, etc.) Clean the blower housing area and blower wheel with an antibacterial / antifungal cleaner. Use a biodegradable cleaning agent and degreaser on condenser fan and condenser shroud. Use warm or cold water when rinsing these items. Allow all items to dry thoroughly before reinstalling them.

3. Periodically (at least yearly or bi-yearly): inspect all control components, both electrical and mechanical, as well as the power supply. Use proper testing instruments (voltmeter, ohmmeter, ammeter, wattmeter, etc.) to perform electrical tests. Use an air conditioning or refrigeration thermometer to check room, outdoor and coil operating temperatures. Use a sling psychrometer to measure wet bulb temperatures indoors and outdoors.
4. Inspect the surrounding area (inside and outside) to ensure that the units' clearances have not been compromised or altered.
5. Inspect the sleeve and drain system periodically (at least yearly or bi-yearly) and clean of all obstructions and debris. Clean both areas with an antibacterial and antifungal cleaner. Rinse both items thoroughly with water and ensure that the drain outlets are operating correctly. Check the sealant around the sleeve and reseal areas as needed.
6. Clean the front cover when needed. Use a mild detergent. Wash and rinse with warm water. Allow it to dry thoroughly before reinstalling it in the chassis.

TROUBLESHOOTING TOUCH TEST CHART: TO SERVICE REVERSING VALVES

NORMAL FUNCTION OF VALVE								
VALVE OPERATING CONDITION	DISCHARGE TUBE from Compressor	SUCTION TUBE to Compressor	Tube to INSIDE COIL	Tube to OUTSIDE COIL	LEFT Pilot Capillary Tube	RIGHT Pilot Capillary Tube	NOTES: * TEMPERATURE OF VALVE BODY ** WARMER THAN VALVE BODY	
	1	2	3	4	5	6	POSSIBLE CAUSES	CORRECTIONS
Normal Cooling	Hot	Cool	Cool as (2)	Hot as (1)	*TVB	TVB		
Normal Heating	Hot	Cool	Hot as (1)	Cool as (2)	*TVB	TVB		
MALFUNCTION OF VALVE								
Valve will not shift from cool to heat.	Check Electrical circuit and coil					No voltage to coil.		Repair electrical circuit.
						Defective coil.		Replace coil.
	Check refrigeration charge					Low charge.		Repair leak, recharge system.
						Pressure differential too high.		Recheck system.
	Hot	Cool	Cool, as (2)	Hot, as (1)	*TVB	Hot	Pilot valve okay. Dirt in one bleeder hole.	Deenergize solenoid, raise head pressure, reenergize solenoid to break dirt loose. If unsuccessful, remove valve, wash out. Check on air before installing. If no movement, replace valve, add strainer to discharge tube, mount valve horizontally.
Valve will not shift from cool to heat.							Piston cup leak	Stop unit. After pressures equalize, restart with solenoid energized. If valve shifts, reattempt with compressor running. If still no shift, replace valve.
	Hot	Cool	Cool, as (2)	Hot, as (1)	*TVB	*TVB	Clogged pilot tubes.	Raise head pressure, operate solenoid to free. If still no shift, replace valve.
	Hot	Cool	Cool, as (2)	Hot, as (1)	Hot	Hot	Both ports of pilot open. (Back seat port did not close).	Raise head pressure, operate solenoid to free partially clogged port. If still no shift, replace valve.
Starts to shift but does not complete reversal.	Warm	Cool	Cool, as (2)	Hot, as (1)	*TVB	Warm	Defective Compressor.	Replace compressor
	Hot	Warm	Warm	Hot	*TVB	Hot	Not enough pressure differential at start of stroke or not enough flow to maintain pressure differential.	Check unit for correct operating pressures and charge. Raise head pressure. If no shift, use valve with smaller port.
							Body damage.	Replace valve
	Hot	Warm	Warm	Hot	Hot	Hot	Both ports of pilot open.	Raise head pressure, operate solenoid. If no shift, use valve with smaller ports.
	Hot	Hot	Hot	Hot	*TVB	Hot	Body damage.	Replace valve
							Valve hung up at mid-stroke. Pumping volume of compressor not sufficient to maintain reversal.	Raise head pressure, operate solenoid. If no shift, use valve with smaller ports.
Apparent leap in heating.	Hot	Hot	Hot	Hot	Hot	Hot	Both ports of pilot open.	Raise head pressure, operate solenoid. If no shift, replace valve.
	Hot	Cool	Hot, as (1)	Cool, as (2)	*TVB	*TVB	Piston needle on end of slide leaking.	Operate valve several times, then recheck. If excessive leak, replace valve.
Will not shift from heat to cool.	Hot	Cool	Hot, as (1)	Cool, as (2)	** WVB	** WVB	Pilot needle and piston needle leaking.	Operate valve several times, then recheck. If excessive leak, replace valve.
	Hot	Cool	Hot, as (1)	Cool, as (2)	*TVB	*TVB	Pressure differential too high.	Stop unit. Will reverse during equalization period. Recheck system
							Clogged pilot tube.	Raise head pressure, operate solenoid to free dirt. If still no shift, replace valve.
	Hot	Cool	Hot, as (1)	Cool, as (2)	Hot	*TVB	Dirt in bleeder hole.	Raise head pressure, operate solenoid. Remove valve and wash out. Check on air before reinstalling, if no movement, replace valve. Add strainer to discharge tube. Mount valve horizontally.
	Hot	Cool	Hot, as (1)	Cool, as (2)	Hot	*TVB	Piston cup leak.	Stop unit. After pressures equalize, restart with solenoid deenergized. If valve shifts, reattempt with compressor running. If it still will not reverse while running, replace the valve.
	Hot	Cool	Hot, as (1)	Cool, as (2)	Hot	Hot	Defective pilot.	Replace valve.
	Warm	Cool	Warm, as (1)	Cool, as (2)	Warm	*TVB	Defective compressor.	Replace compressor

COOLING ONLY ROOM AIR CONDITIONERS: TROUBLESHOOTING TIPS

Problem	Possible Cause	Action
Compressor does not run	Low voltage	Check voltage at compressor. 115V & 230V units will operate at 10% voltage variance
	T-stat not set cold enough or inoperative	Set t-stat to coldest position. Test t-stat & replace if inoperative
	Compressor hums but cuts off on B10overload	Hard start compressor. Direct test compressor. If compressor starts, add starting components
	Open or shorted compressor windings	Check for continuity & resistance
	Open overload	Test overload protector & replace if inoperative
	Open capacitor	Test capacitor & replace if inoperative
	Inoperative system switch	Test for continuity in all positions. Replace if inoperative
	Broken, loose or incorrect wiring	Refer to appropriate wiring diagrams to check wiring

Problem	Possible Cause	Action
Fan motor does not run	Inoperative system switch	Test switch & replace if inoperative
	Broken, loose or incorrect wiring	Refer to applicable wiring diagram
	Open capacitor	Test capacitor & replace if inoperative
	Fan speed switch open	Test switch & replace if inoperative
	Inoperative fan motor	Test fan motor & replace if inoperative (be sure internal overload has had time to reset)

Problem	Possible Cause	Action
Does not cool or only cools slightly	Undersized unit	Refer to industry standard sizing chart
	T-stat open or inoperative	Set to coldest position. Test t-stat & replace if necessary
	Dirty filter	Clean as recommended in Owner's Manual
	Dirty or restricted condenser or evaporator coil	Use pressure wash or biodegradable cleaning agent to clean
	Poor air circulation	Adjust discharge louvers. Use high fan speed
	Fresh air or exhaust air door open on applicable models	Close doors. Instruct customer on use of this feature
	Low capacity - undercharge	Check for leak & make repair
	Compressor not pumping properly	Check amperage draw against nameplate. If not conclusive, make pressure test

Problem	Possible Cause	Action
Unit does not run	Fuse blown or circuit tripped	Replace fuse, reset breaker. If repeats, check fuse or breaker size. Check for shorts in unit wiring & components
	Power cord not plugged in	Plug it in
	System switch in "OFF" position	Set switch correctly
	Inoperative system switch	Test for continuity in each switch position
	Loose or disconnected wiring at switch or other components	Check wiring & connections. Reconnect per wiring diagram

Problem	Possible Cause	Action
Evaporator coil freezes up	Dirty filter	Clean as recommended in Owner's Manual
	Restricted airflow	Check for dirty or obstructed coil. Use pressure wash or biodegradable cleaning agent to clean
	Inoperative t-stat	Test for shorted t-stat or stuck contacts
	Short of refrigerant	De-ice coil & check for leak
	Inoperative fan motor	Test fan motor & replace if inoperative
	Partially restricted capillary tube	De-ice coil. Check temp. differential (delta T) across coil. Touch test coil return bends for same temp. Test for low running current

Problem	Possible Cause	Action
Compressor runs continually & does not cycle off	Excessive heat load	Unit undersized. Test cooling performance & replace with larger unit if needed
	Restriction in line	Check for partially iced coil & check temperature split across coil
	Refrigerant leak	Check for oil at silver soldered connections. Check for partially iced coil. Check split across coil. Check for low running amperage
	T-stat contacts stuck	Check operation of t-stat. Replace if contacts remain closed.
	T-stat incorrectly wired	Refer to appropriate wiring diagram

Problem	Possible Cause	Action
T-stat does not turn unit off	T-stat contacts stuck	Disconnect power to unit. Remove cover of t-stat & check if contacts are stuck. If so, replace t-stat
	T-stat set at coldest point	Turn to higher temp. setting to see if unit cycles off
	Incorrect wiring	Refer to appropriate wiring diagrams
	Unit undersized for area to be cooled	Refer to industry standard sizing chart

Problem	Possible Cause	Action
Compressor runs for short periods only. Cycles on overload	Overload inoperative. Opens too soon	Check operation of unit. Replace overload if system operation is satisfactory
	Compressor restarted before system pressures equalized	Allow a minimum of 2 minutes to allow pressures to equalize before attempting to restart. Instruct customer of waiting period
	Low or fluctuating voltage	Check voltage with unit operating. Check for other appliances on circuit. Air conditioner should be in separate circuit for proper voltage & fused separately
	Incorrect wiring	Refer to appropriate wiring diagram
	Shorted or incorrect capacitor	Check by substituting a known good capacitor of correct rating
	Restricted or low air flow through condenser coil	Check for proper fan speed or blocked condenser
	Compressor running abnormally hot	Check for kinked discharge line or restricted condenser. Check amperage

Problem	Possible Cause	Action
T-stat does not turn unit on	Loss of charge in t-stat bulb	Place jumper across t-stat terminals to check if unit operates. If unit operates, replace t-stat.
	Loose or broken parts in t-stat	Check as above
	Incorrect wiring	Refer to appropriate wiring diagram

Problem	Possible Cause	Action
Noisy operation	Poorly installed	Refer to Installation Manual for proper installation
	Fan blade striking chassis	Reposition - adjust motor mount
	Compressor vibrating	Check that compressor grommets have not deteriorated. Check that compressor mounting parts are not missing
	Improperly mounted or loose cabinet parts	Check assembly & parts for looseness, rubbing & rattling

Problem	Possible Cause	Action
Water leaks into the room	Evaporator drain pan overflowing	Clean obstructed drain trough
	Condensation forming on base pan	Evaporator drain pan broken or cracked. Reseal or replace
	Poor installation resulting in rain entering the room	Check installation instructions. Reseal as required
	Condensation on discharge grille louvers	Clean the dirty evaporator coil. Use pressure wash or biodegradable cleaning agent to clean
	Chassis gasket not installed	Install gasket, per Installation manual
	Downward slope of unit is too steep	Refer to installation manual for proper installation

Problem	Possible Cause	Action
Water "spitting" into room	Sublimation: When unconditioned saturated, outside air mixes with conditioned air, condensation forms on the cooler surfaces	Ensure that foam gaskets are installed in between window panes & in between the unit & the sleeve. Also, ensure that fresh air/exhaust vents (on applicable models) are in the closed position & are in tact
	Downward pitch of installation is too steep	Follow installation instructions to ensure that donward pitch of installed unit is no less than 1/4" & no more than 3/8"
	Restricted coil or dirty filter	Clean & advise customer of periodic cleaning & maintenance needs of entire unit

Problem	Possible Cause	Action
Excessive moisture	Insufficient air circulation thru area to be air conditioned	Adjust louvers for best possible air circulation
	Oversized unit	Operate in "MoneySaver" position
	Inadequate vapor barrier in building structure, particularly floors	Advise customer

Problem	Possible Cause	Action
T-stat short cycles	T-stat differential too narrow	Replace t-stat
	Plenum gasket not sealing, allowing discharge air to short cycle t-stat	Check gasket. Reposition or replace as needed
	Restricted coil or dirty filter	Clean & advise customer of periodic cleaning & maintenance needs of entire unit

Problem	Possible Cause	Action
Prolonged off cycles (automatic operation)	Anticipator (resistor) wire disconnected at t-stat or system switch	Refer to appropriate wiring diagram
	Anticipator (resistor) shorted or open	Disconnect plus from outlet. Remove resistor from bracket. Insert plug & depress "COOL" & "FAN AUTOMATIC" buttons. Place t-stat to warmest setting. Feel resistor for temperature. If no heat, replace resistor
	Partial loss of charge in t-stat bulb causing a wide differential	Replace t-stat

Problem	Possible Cause	Action
Outside water leaks	Evaporator drain pan cracked or obstructed	Repair, clean or replace as required
	Water in compressor area	Detach shroud from pan & coil. Clean & remove old sealer. Reseal, reinstall & check
	Obstructed condenser coil	Use pressure wash or biodegradable cleaning agent to clean
	Fan blade/slinger ring improperly positioned	Adjust fan blade to 1/2" of condenser coil

HEAT / COOL ROOM AIR CONDITIONERS: TROUBLESHOOTING TIPS

Problem	Possible Cause	Action
Room temperature uneven (Heating cycle)	Heat anticipator (resistor) shorted (on applicable models)	Disconnect power to unit. Remove resistor from t-stat bulb block. Plus in unit & allow to operate. Feel resistor for heat. If not heat, replace resistor
	Wide differential - partial loss of t-stat bulb charge	Replace t-stat & check
	Incorrect wiring	Refer to appropriate wiring diagram. Resistor is energized during "ON" cycle of compressor or fan.

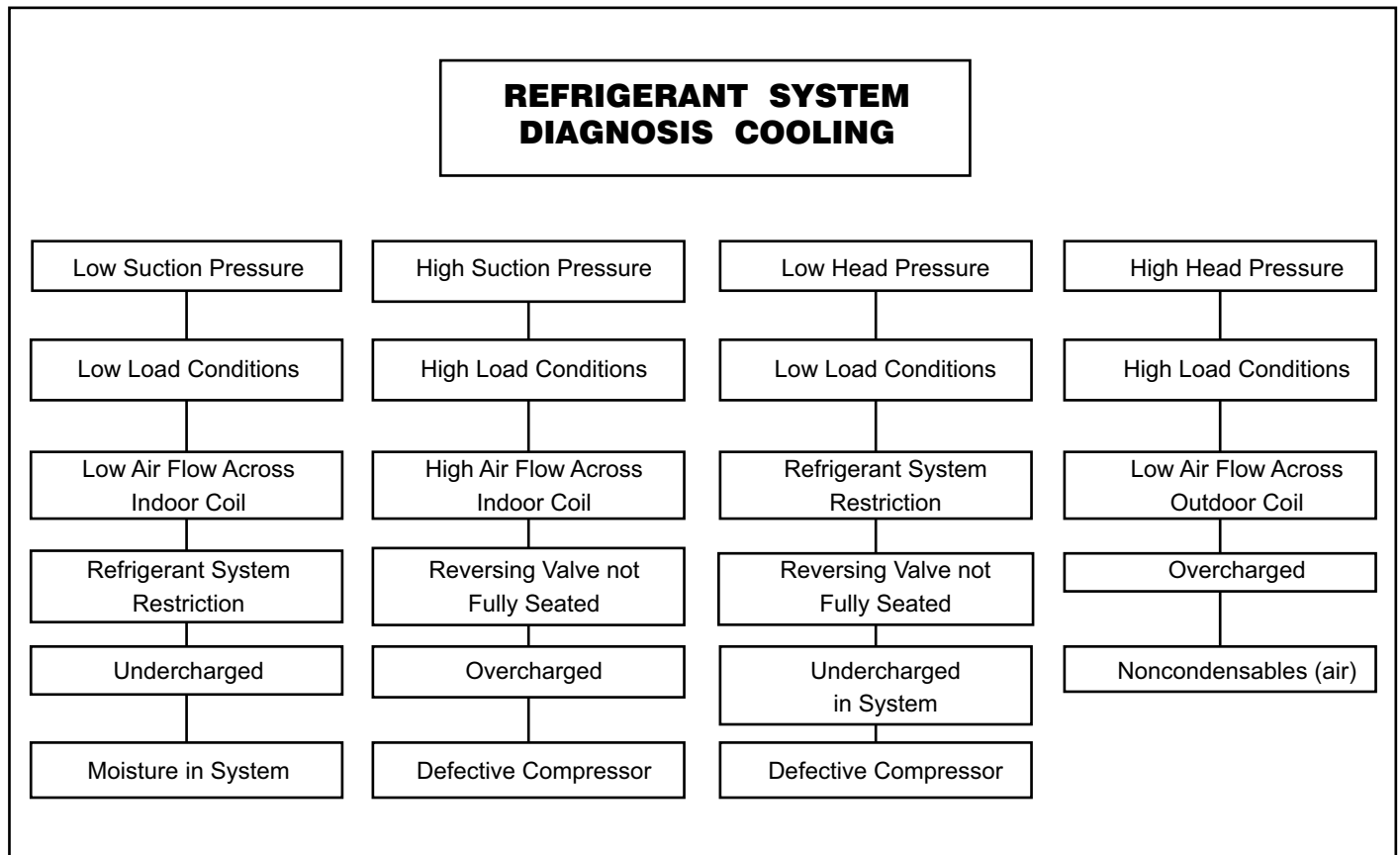
Problem	Possible Cause	Action
Unit will not defrost	Incorrect wiring	Refer to appropriate wiring diagram
	Defrost control timer motor not advancing (applicable models)	Check for voltage at "TM" & "TM1" on timer. If no voltage, replace control
	Defrost control out of calibration (applicable models)	If outside coil temperature is 25F or below, & preselected time limit has elapsed, replace defrost control
	Defrost control contacts stuck	If contacts remain closed between terminals "2" & "3" of the defrost control after preselected time interval has passed, replace control
	Defrost control bulb removed from or not making good coil contact	Reinstall & be assured that good bulb to coil contact is made

Problem	Possible Cause	Action
Does not heat adequately	Exhaust or fresh air door open	Check if operating properly. Instruct customer on proper use of control
	Dirty filter	Clean as recommended in Owner's Manual
	Unit undersized	Check heat rise across coil. If unit operates efficiently, check if insulation can be added to attic or walls. If insulation is adequate, recommend additional unit or larger one
	Outdoor t-stat open (applicable models)	T-stat should close at 38F. Check continuity of control. If temperature is below 38F, replace control
	Heater hi-limit control cycling on & off	Check for adequate fan air across heater. Check control for open at 160F & close at 150F
	Shorted supplementary heater	Ohmmeter check, approx. 32-35 ohms
	Incorrect wiring	Check applicable wiring diagram

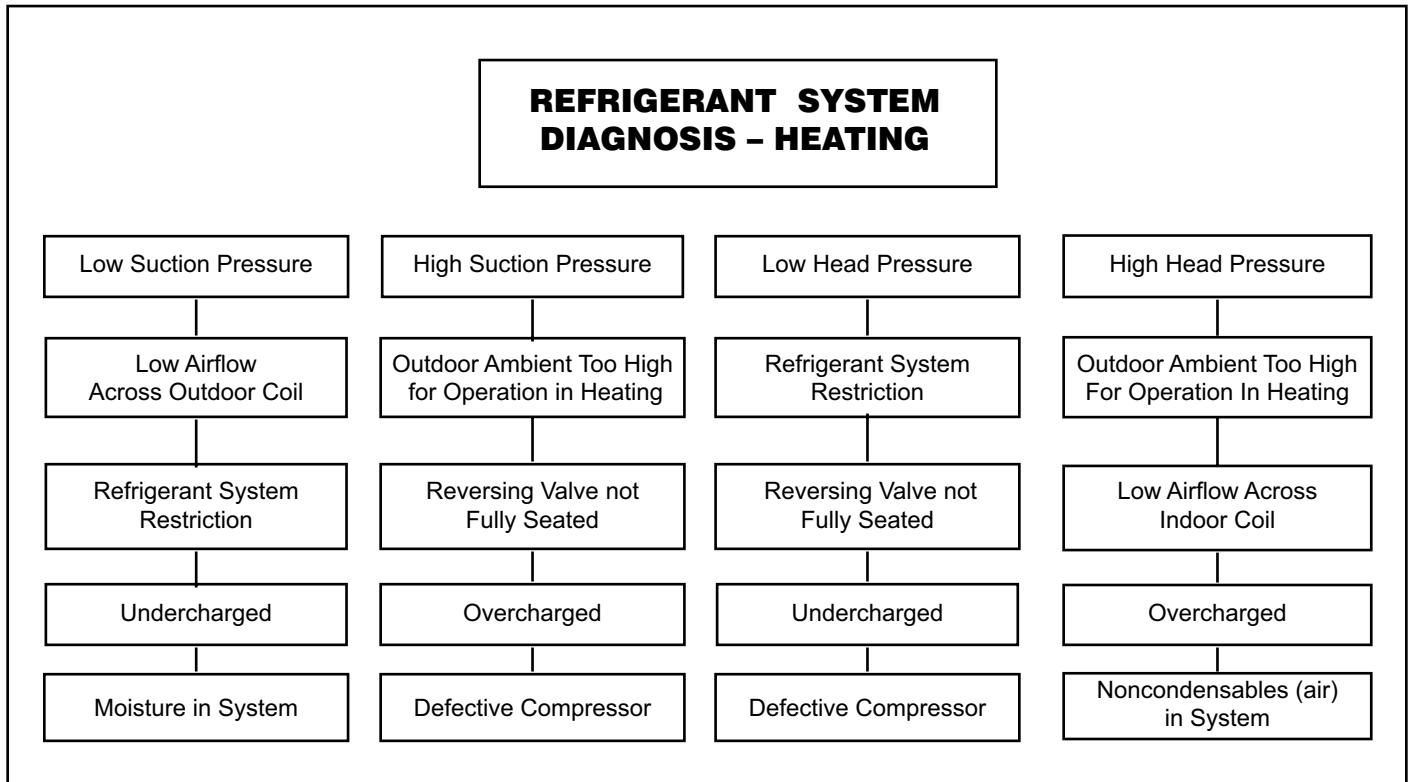
Problem	Possible Cause	Action
Unit cools when heat is called for	Incorrect wiring	Refer to applicable wiring diagram
	Defective solenoid coil	Check for continuity of coil
	Reversing valve fails to shift	Block condenser coil & switch unit to cooling. Allow pressure to build up in system, then switch to heating. If valve fails to shift, replace valve.
	Inoperative system switch	Check for continuity of system switch

Problem	Possible Cause	Action
Cooling adequate, but heating insufficient	Heating capillary tube partially restricted	Check for partially starved outer coil. Replace heating capillary tube
	Check valve leaking internally	Switch unit several times from heating to cooling. Check temperature rise across coil. Refer to specification sheet for correct temperature rise
	Reversing valve failing to shift completely; bypassing hot gas	Deenergize solenoid coil, raise head pressure, energize solenoid to break loose. If valve fails to make complete shift, replace valve.

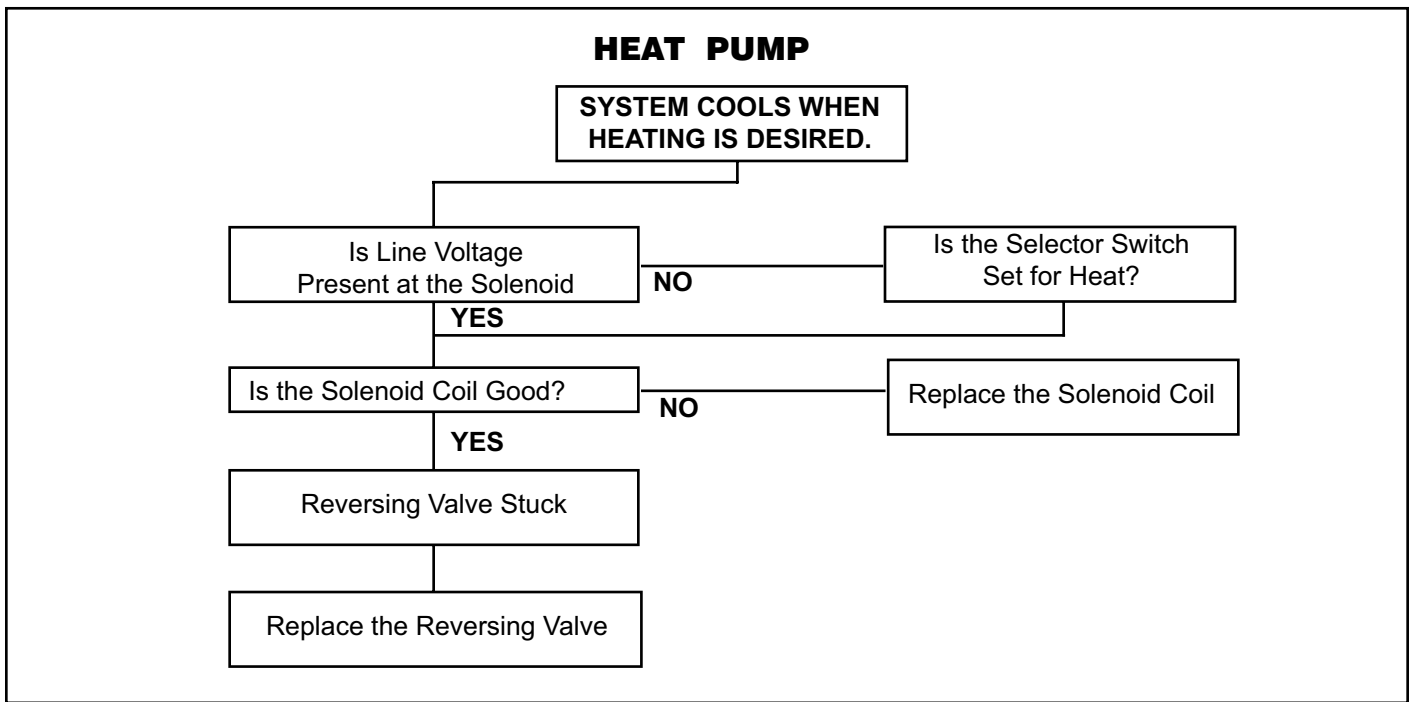
TROUBLESHOOTING CHART — COOLING



TROUBLESHOOTING CHART — HEATING

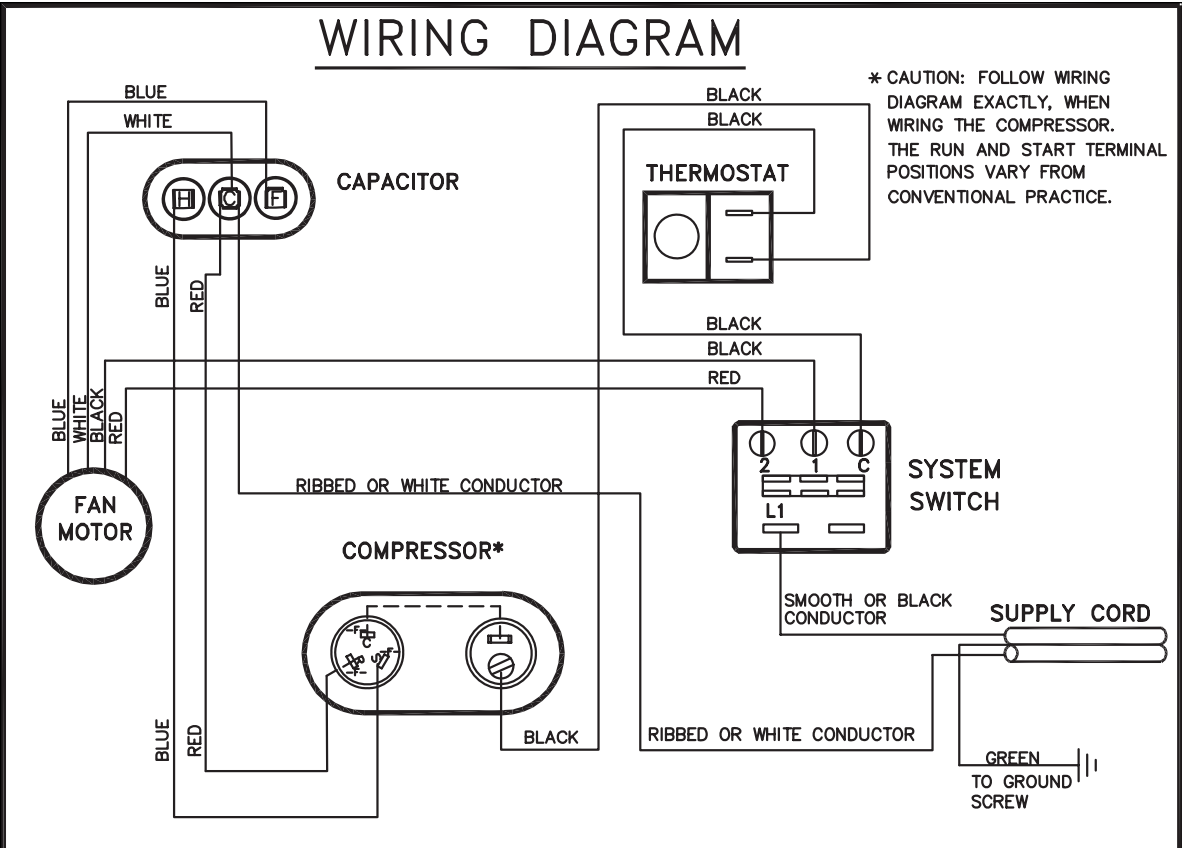


ELECTRICAL TROUBLESHOOTING CHART — HEAT PUMP

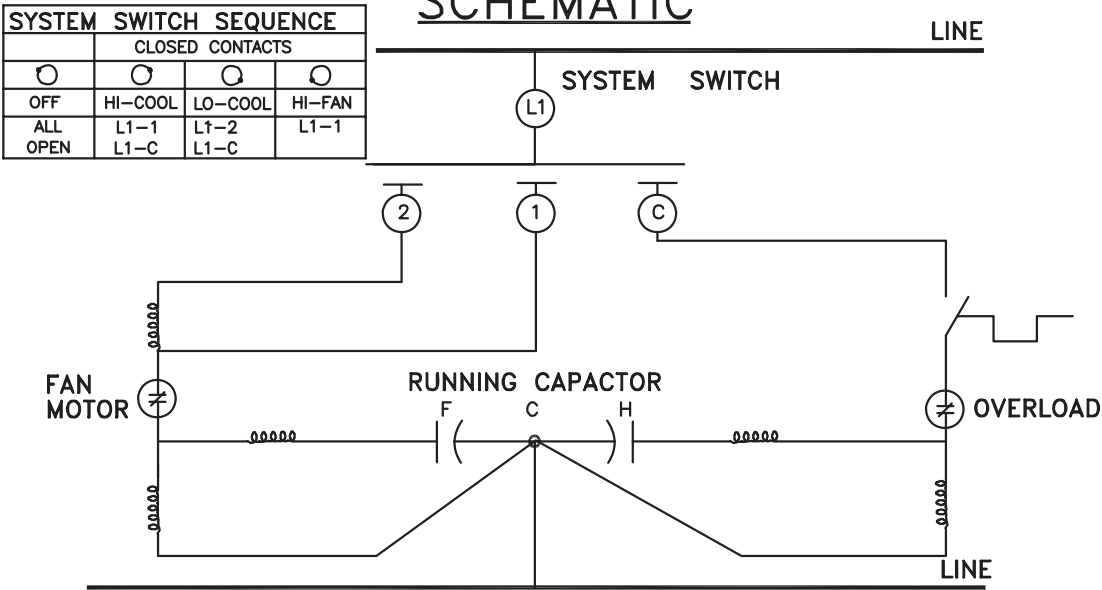


MODEL SC06H10D

WIRING DIAGRAM



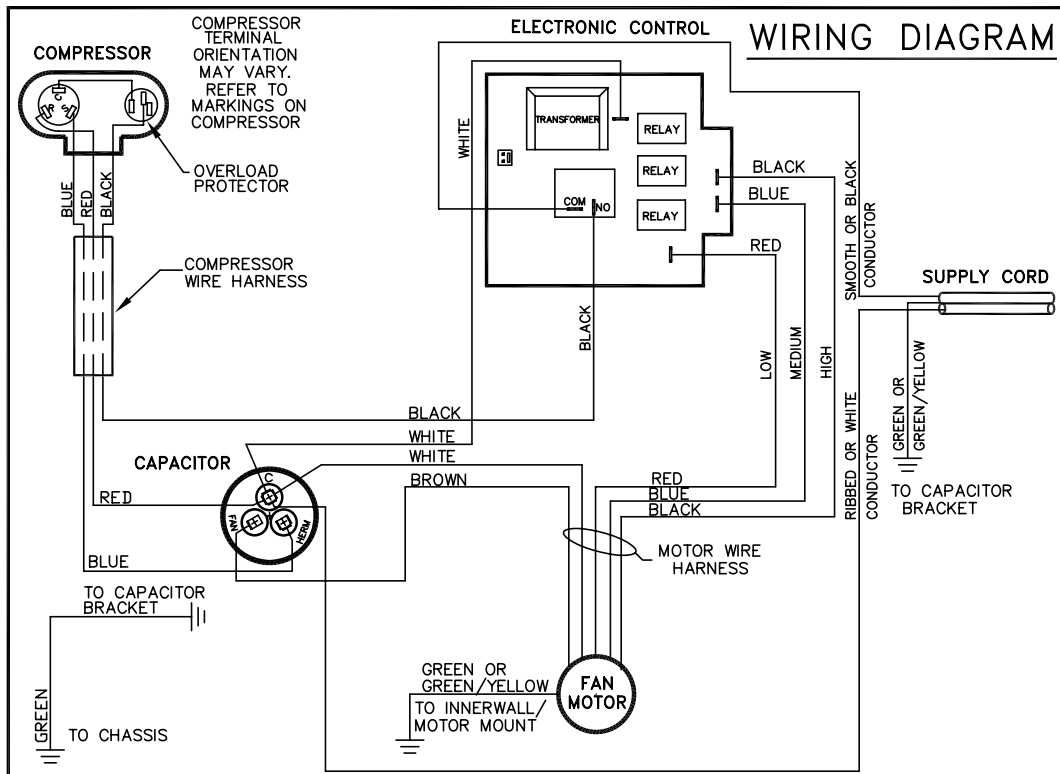
SCHEMATIC



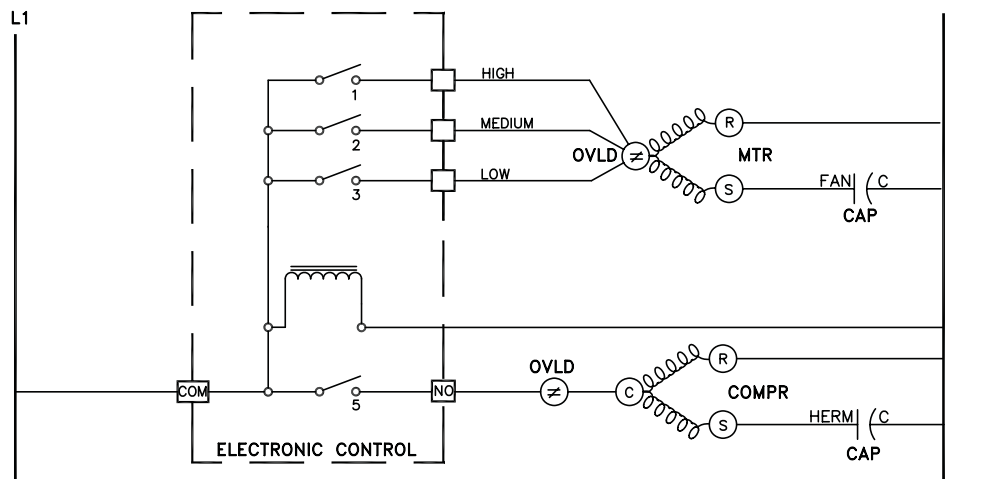
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MODELS

XQ05L10-A,B; XQ06L10-A,B,C,D; XQ08L10-A,B; XQ10L10-A,B; XQ12L10-A,B



SCHEMATIC



SWITCH LOGIC

X = CLOSED
O = OPEN

SWITCH POSITION	1	2	3	4	5
OFF	O	O	O	O	O
HI COOL	X	O	O	O	X
MED COOL	O	X	O	O	X
LOW COOL	O	O	X	O	X

LEGEND

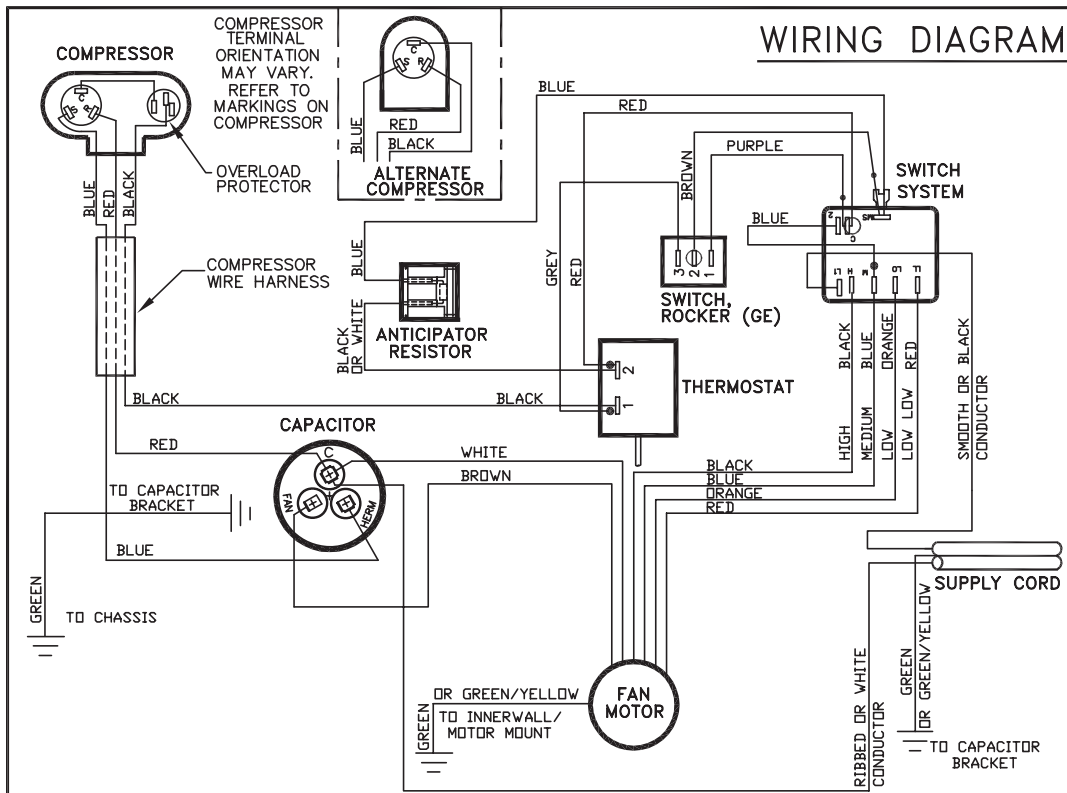
CAP - CAPACITOR
COMPR - COMPRESSOR
MTR - FAN MOTOR
OVL - OVERLOAD PROTECTOR

● - COMBINATION TERMINAL
—||— - GROUND LEAD

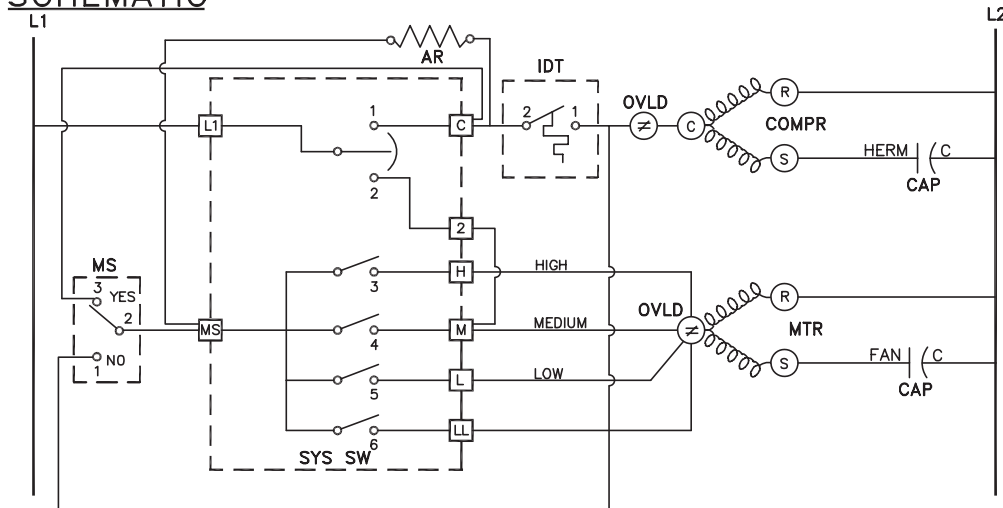
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REV. 05

MODELS

KS10L10-A, RS10L10-A, KS12L10-A, KS12L30-A, KS15L10-A, RS15L10-A, RS16L30-A,
RM18L30-A, KM18L30-A, KM21L30-A, RM24L30-A, KM24L30-A



SCHEMATIC



SWITCH LOGIC

SWITCH POSITION	CIRCUIT					
	1	2	3	4	5	6
OFF	0	0	0	0	0	0
LOW COOL	X	0	0	0	X	0
MED COOL	X	0	0	X	0	0
HI COOL	X	0	X	0	0	0
FAN ONLY	0	X	0	0	0	0
LL COOL	X	0	0	0	0	X

X = CLOSED
0 = OPEN

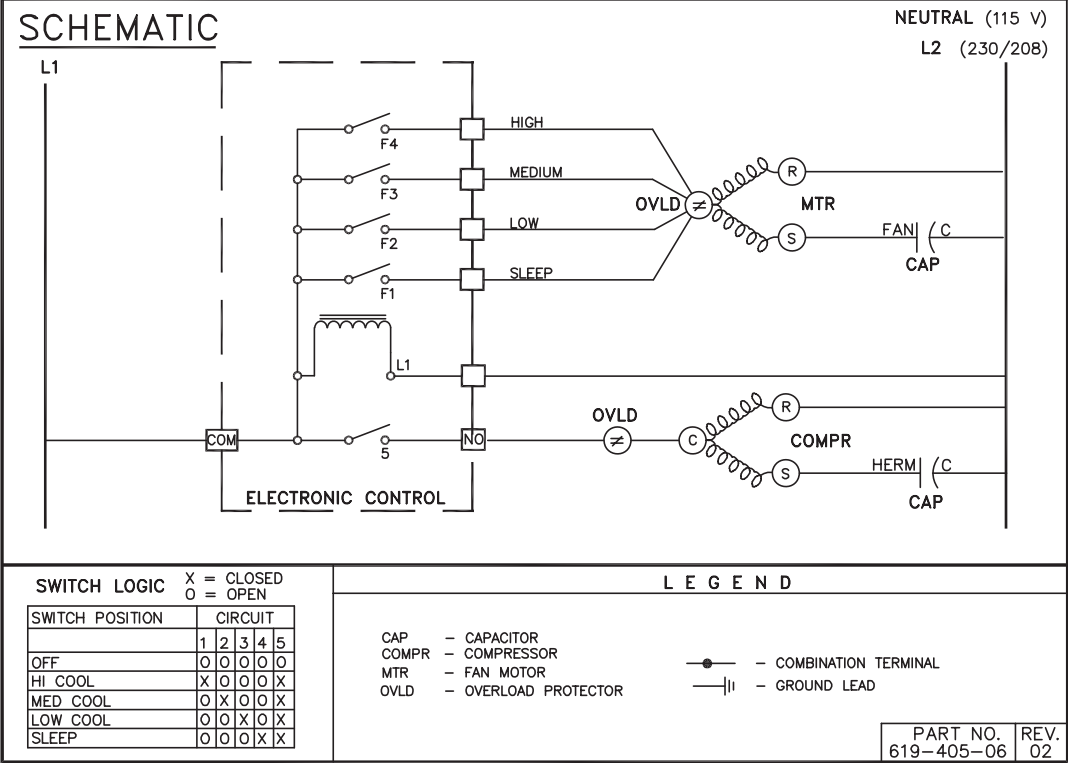
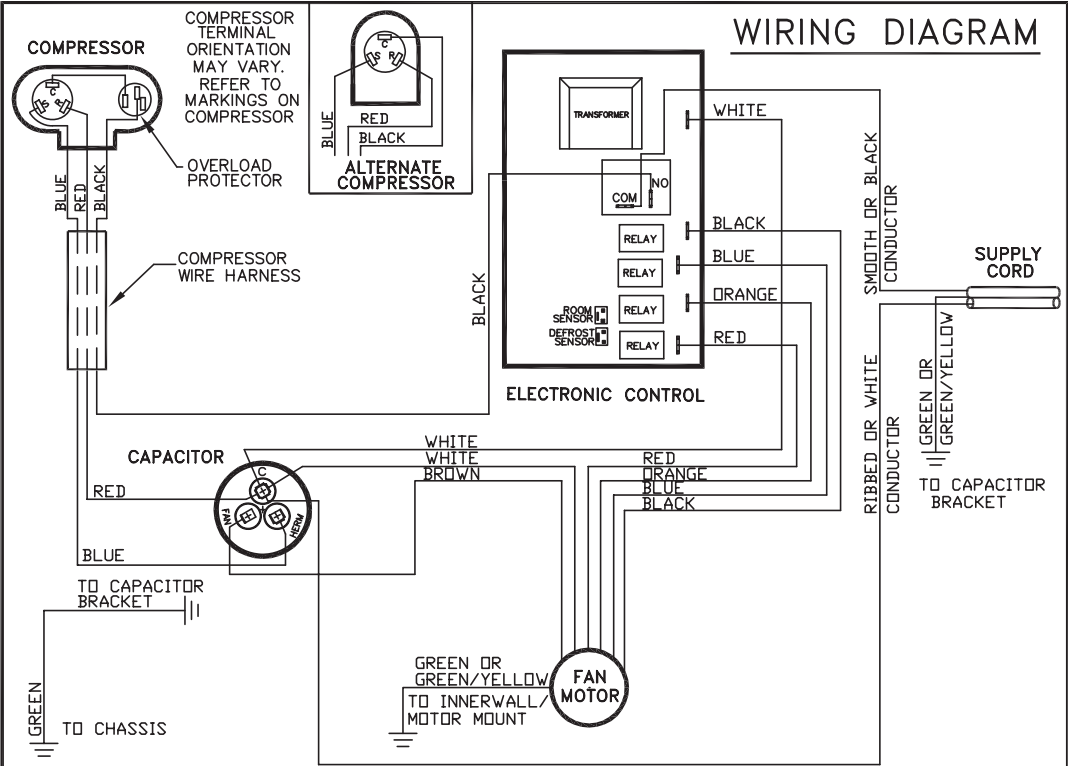
LEGEND

AR - ANTICIPATOR RESISTOR
MS - MONEY SAVER/ROCKER SWITCH
CAP - CAPACITOR
COMPR - COMPRESSOR
MTR - FAN MOTOR
OVL - OVERLOAD PROTECTOR
SYS SW - SYSTEM SWITCH
IDT - INDOOR THERMOSTAT

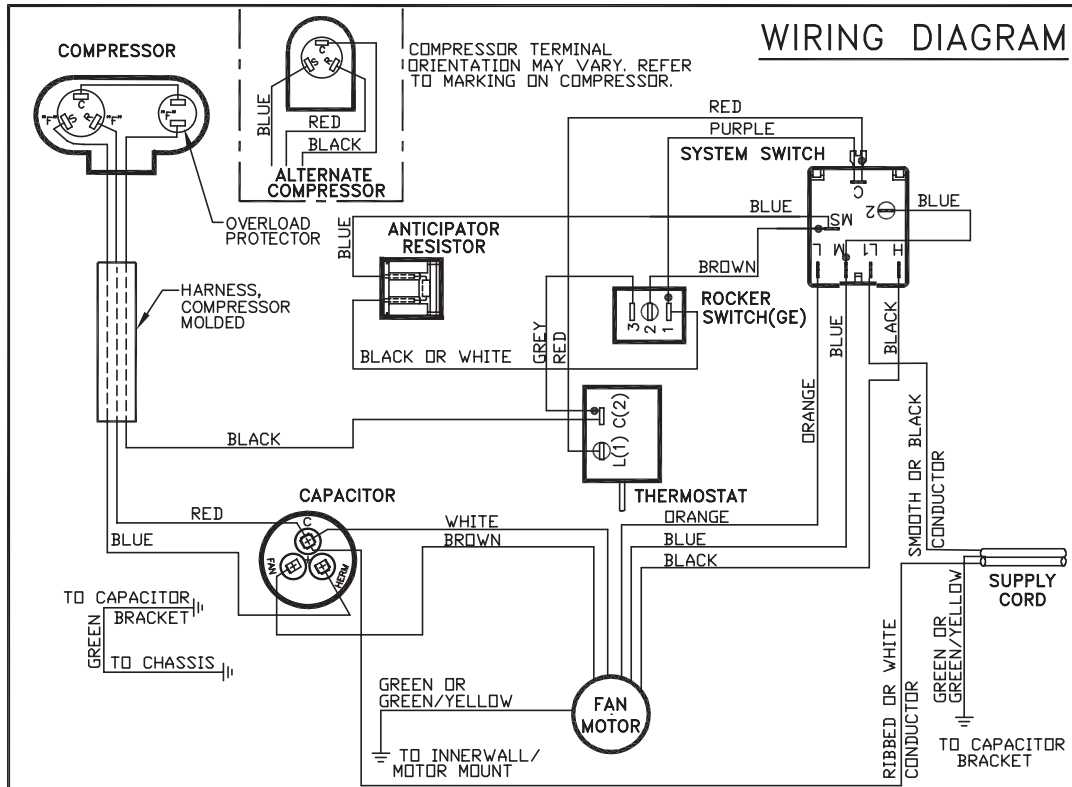
— GROUND LEAD
— COMBINATION TERMINAL
— PLASTIC INSULATOR

PART NO. 619-405-00
REV 01

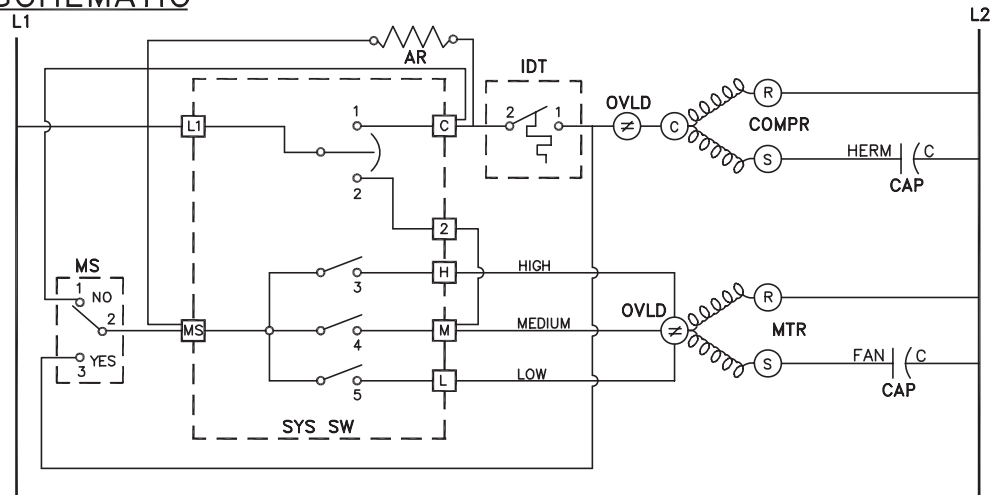
MODELS **SS10L10-A/B, SS12L10-A/B; SS12L30-A/B, SS14L10-A/B,** **SS16L30-A/B, SM18L30-A/B, SM21L30-A/B**



MODELS SL25L30-A, SL36L30-A



SCHEMATIC



SWITCH LOGIC

X = CLOSED
O = OPEN

SWITCH POSITION	1	2	3	4	5
OFF	O	O	O	O	O
LOW COOL	X	O	O	O	X
MED COOL	X	O	O	X	O
HI COOL	X	O	X	O	O
FAN ONLY	O	X	O	O	O

LEGEND

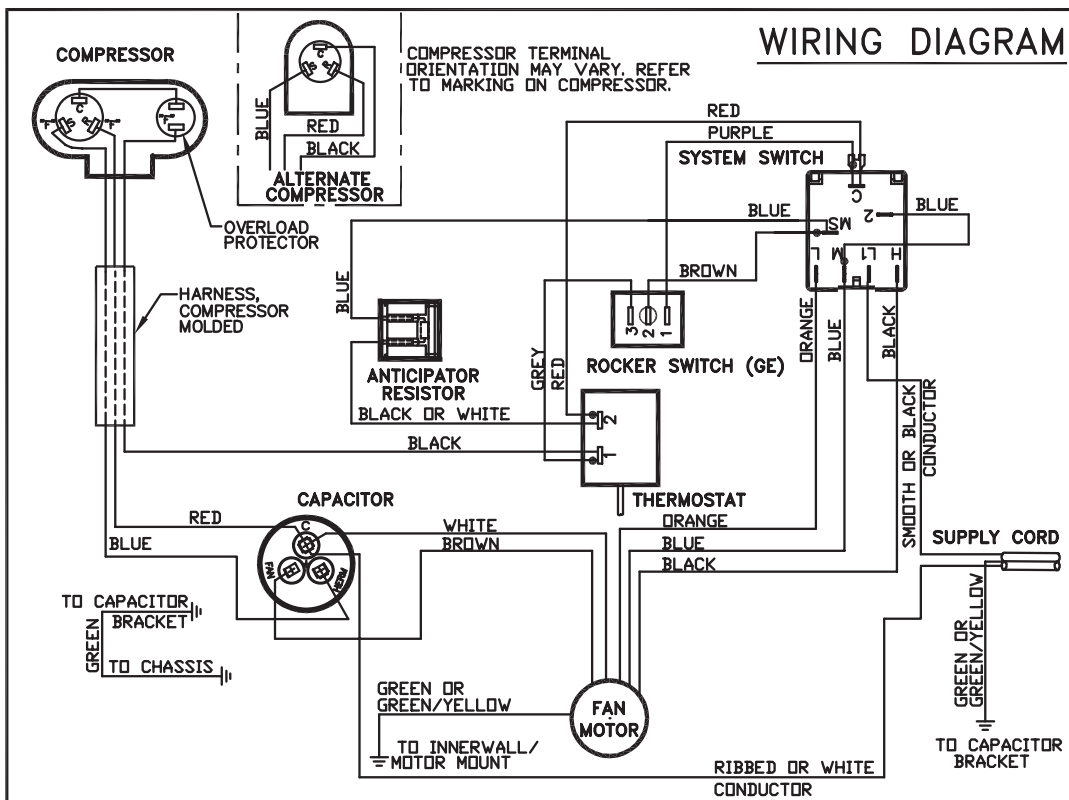
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MS - MONEY SAVER/ROCKER SWITCH
CAP - CAPACITOR
COMP - COMPRESSOR
MTR - FAN MOTOR
OVLD - OVERLOAD PROTECTOR
SYS SW - SYSTEM SWITCH
IDT - INDOOR THERMOSTAT

—||— GROUND LEAD
—●— COMBINATION TERMINAL
○ PLASTIC INSULATOR

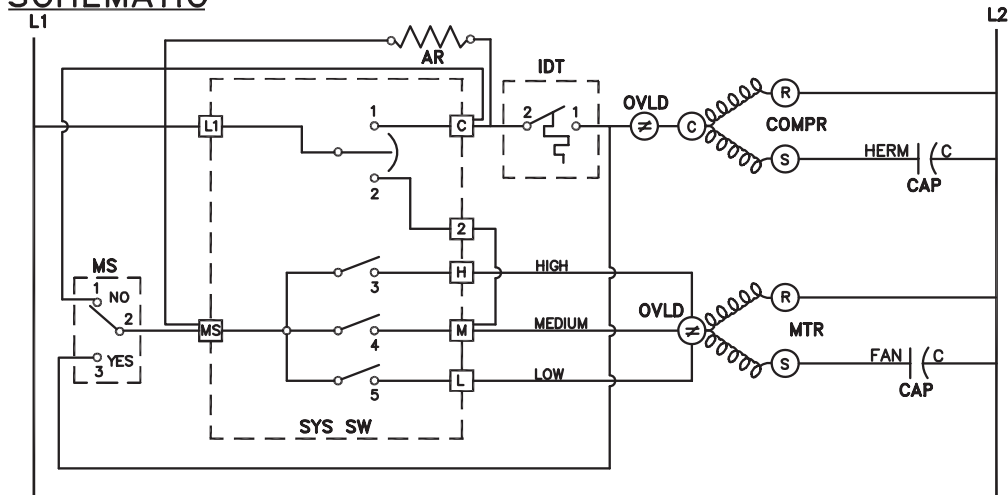
PART NO.
619-405-11

REV.
02

MODELS
SL28L30-A



SCHEMATIC



SWITCH LOGIC

X = CLOSED
0 = OPEN

SWITCH POSITION	CIRCUIT				
	1	2	3	4	5
OFF	0	0	0	0	0
LOW COOL	X	0	0	0	X
MED COOL	X	0	X	0	0
HI COOL	X	X	0	X	0
FAN ONLY	0	X	0	0	0

LEGEND

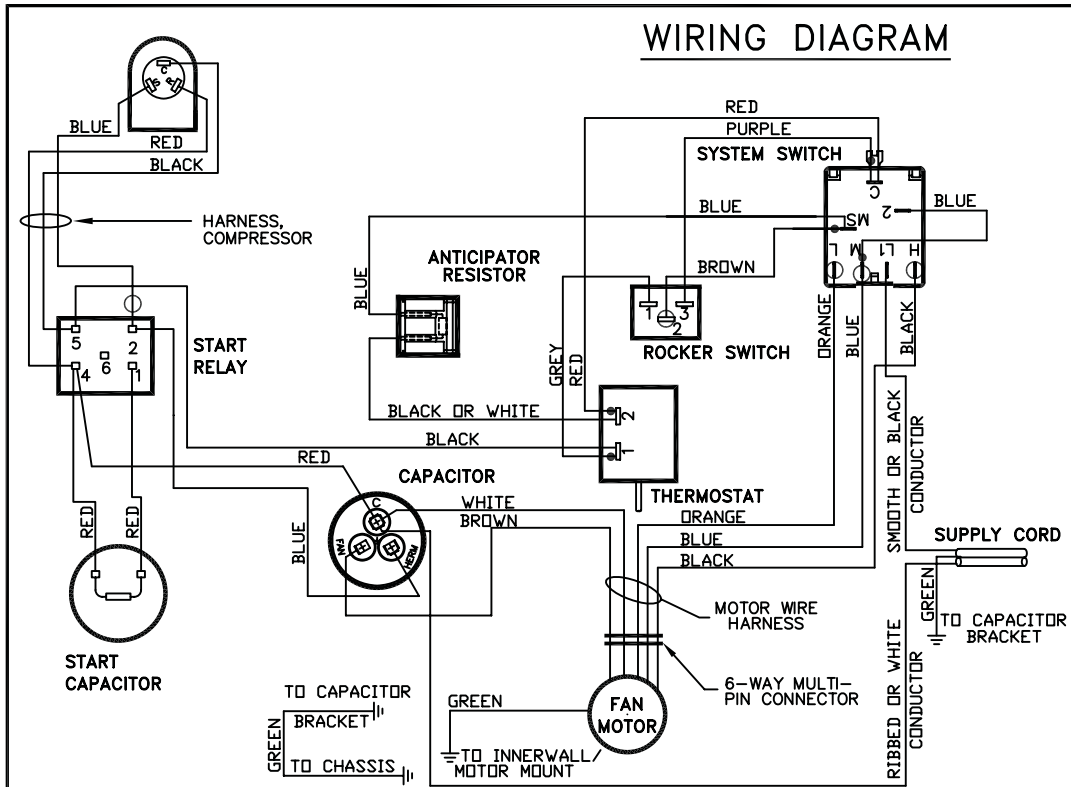
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- MS - MONEY SAVER/ROCKER SWITCH
- CAP - CAPACITOR
- COMPR - COMPRESSOR
- MTR - FAN MOTOR
- OVL D - OVERLOAD PROTECTOR
- SYS SW - SYSTEM SWITCH
- IDT - INDOOR THERMOSTAT



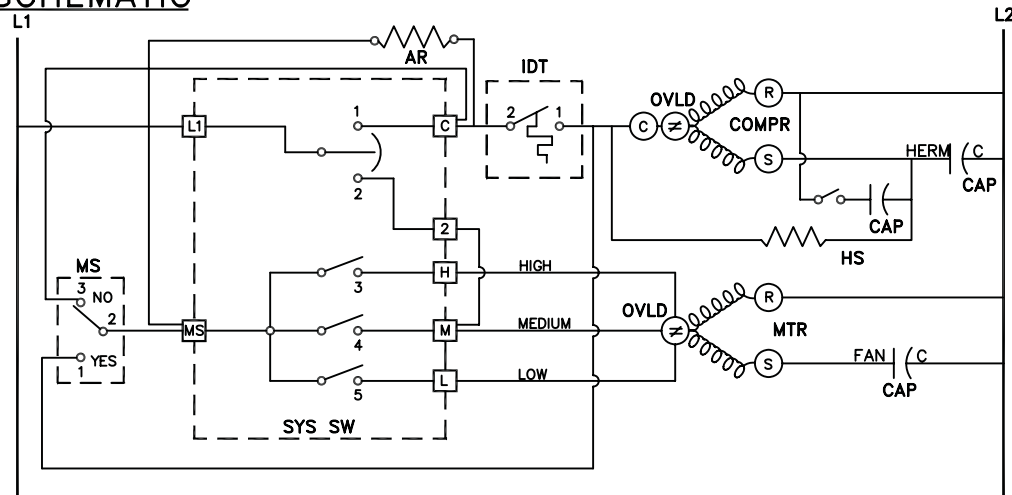
PART NO. 619-405-01	REV. 01
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MODELS SL36L30-B

WIRING DIAGRAM



SCHEMATIC



SWITCH LOGIC

X = CLOSED
O = OPEN

SWITCH POSITION	1	2	3	4	5
OFF	O	O	O	O	O
LOW COOL	X	O	O	O	X
MED COOL	X	O	O	X	O
HI COOL	X	O	X	O	O
FAN ONLY	O	X	O	O	O

LEGEND

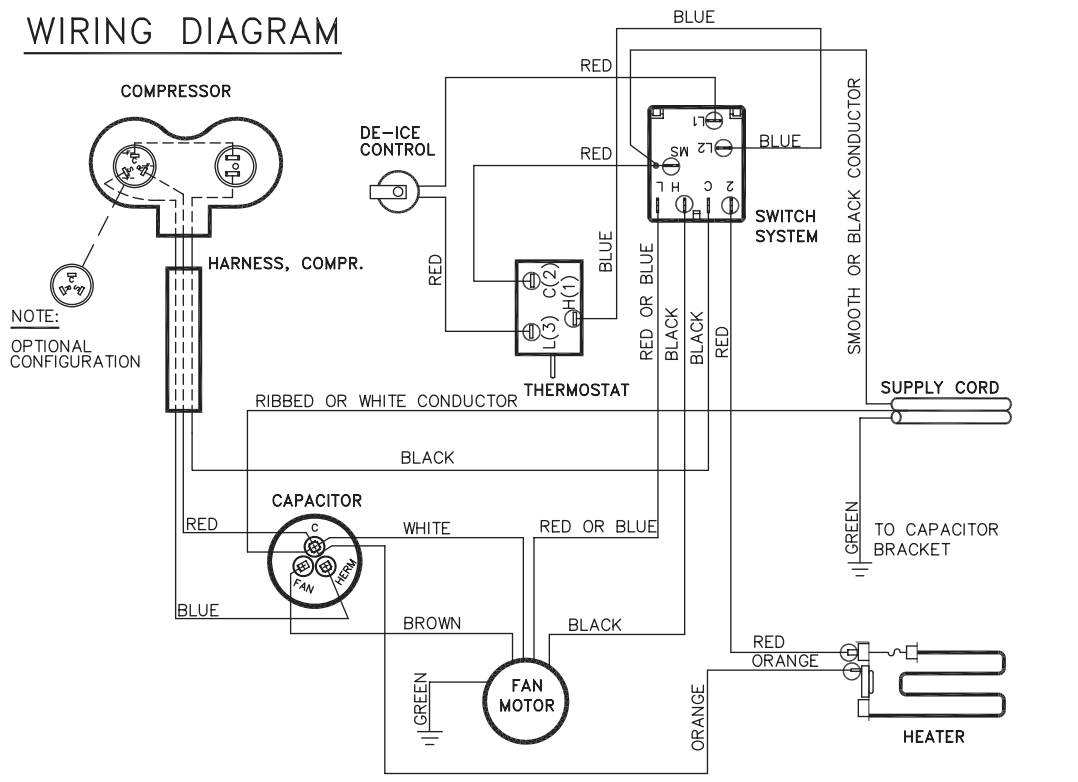
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MS - MONEY SAVER/ROCKER SWITCH
CAP - CAPACITOR
COMPR - COMPRESSOR
MTR - FAN MOTOR
OVLD - OVERLOAD PROTECTOR
SYS SW - SYSTEM SWITCH
IDT - INDOOR THERMOSTAT
HS - HARD START KIT

—||— - GROUND LEAD
—●— - COMBINATION TERMINAL
○ - PLASTIC INSULATOR

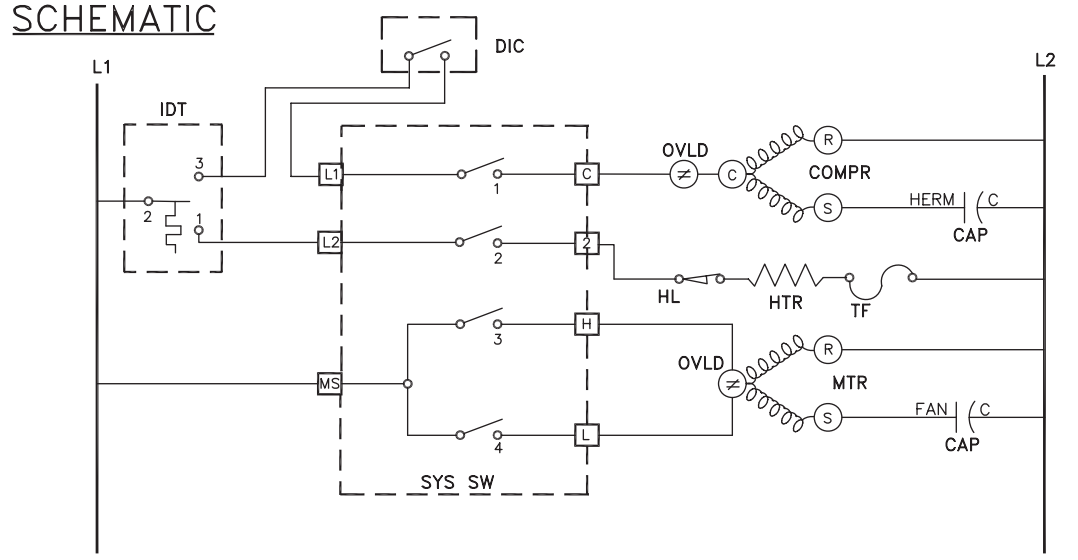
PART NO. 619-142-13
REV. 02

MODEL EQ08L11-A

WIRING DIAGRAM



SCHEMATIC



SWITCH LOGIC

SWITCH POSITION	CIRCUIT			
	1	2	3	4
OFF	1	0	0	0
FAN	2	0	0	X
HI COOL	3	X	0	X
LOW COOL	4	X	0	X
LOW HEAT	5	0	X	X
HI HEAT	6	0	X	X

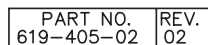
X = CLOSED
0 = OPEN

LEGEND

HL	- HEATER LIMIT	TF	- THERMAL FUSE
CAP	- CAPACITOR	○	- INSULATED TERMINAL
COMP	- COMPRESSOR	— —	- GROUND LEAD
MTR	- FAN MOTOR	—F—	- COMBINATION TERMINAL
OVLD	- OVERLOAD PROTECTOR	—F—	- FLAG TERMINAL
SYS SW	- SYSTEM SWITCH	DIC	- DE ICE CONTROL
IDT	- INDOOR THERMOSTAT		
HTR	- HEATER		

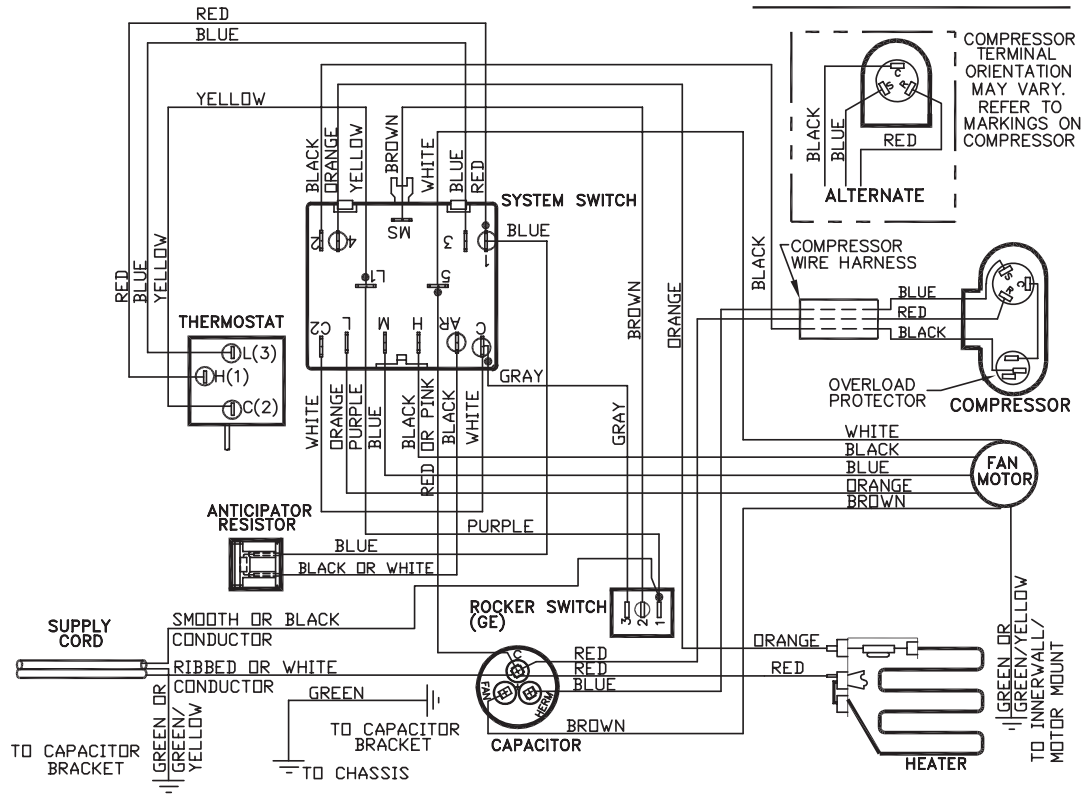
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WIRING DIAGRAM

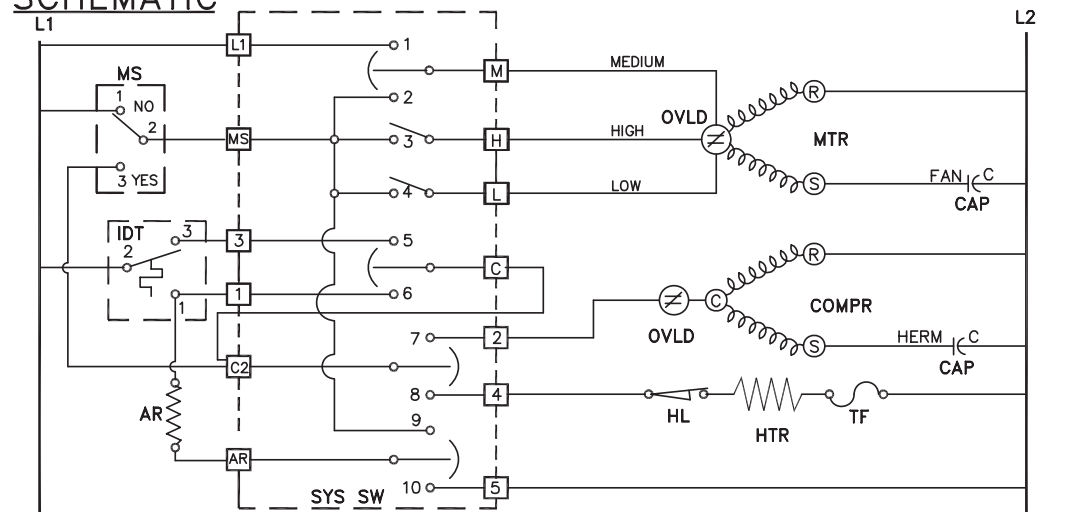


MODEL EL36L35-A

WIRING DIAGRAM



SCHEMATIC



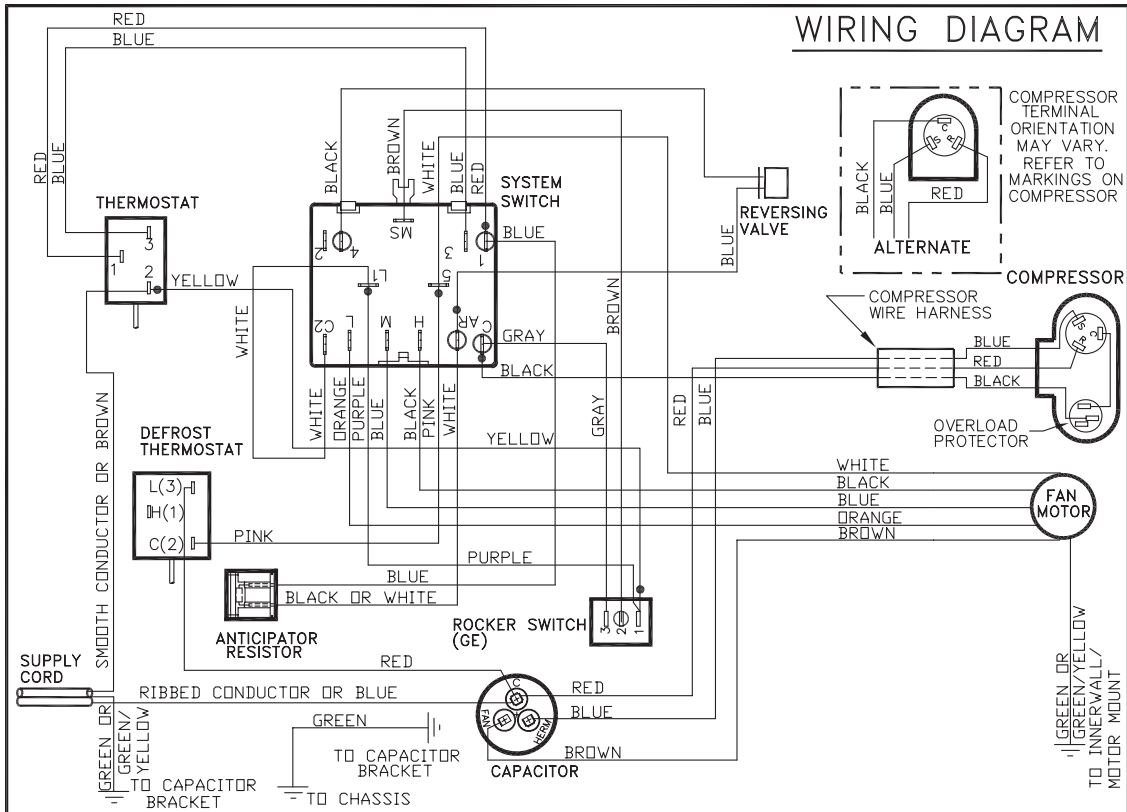
SWITCH LOGIC		X = CLOSED O = OPEN									
SWITCH POSITION	CIRCUIT	1	2	3	4	5	6	7	8	9	10
OFF		O	O	O	O	O	O	O	O	O	O
LOW COOL		O	O	O	X	O	O	O	O	O	O
MEDIUM COOL		O	X	O	O	X	O	O	O	O	O
HIGH COOL		O	O	X	O	O	X	O	O	O	O
HIGH HEAT		O	O	O	X	O	O	X	O	O	O
MEDIUM HEAT		O	X	O	O	O	X	O	O	O	O
LOW HEAT		O	O	O	X	O	O	O	X	O	O
FAN ONLY		X	O	O	O	O	O	O	O	O	O

- LEGEND**
- AR - ANTICIPATOR RESISTOR
 - MS - MONEY SAVER/ROCKER SWITCH
 - CAP - CAPACITOR
 - COMPR - COMPRESSOR
 - MTR - FAN MOTOR
 - OVLD - OVERLOAD PROTECTOR
 - SYS SW - SYSTEM SWITCH
 - IDT - INDOOR THERMOSTAT
 - HTR - HEATER
 - HL - HEATER LIMIT
 - TF - THERMAL FUSE
 - | — - GROUND LEAD
 - • — - COMBINATION TERMINAL
 - - PLASTIC INSULATOR

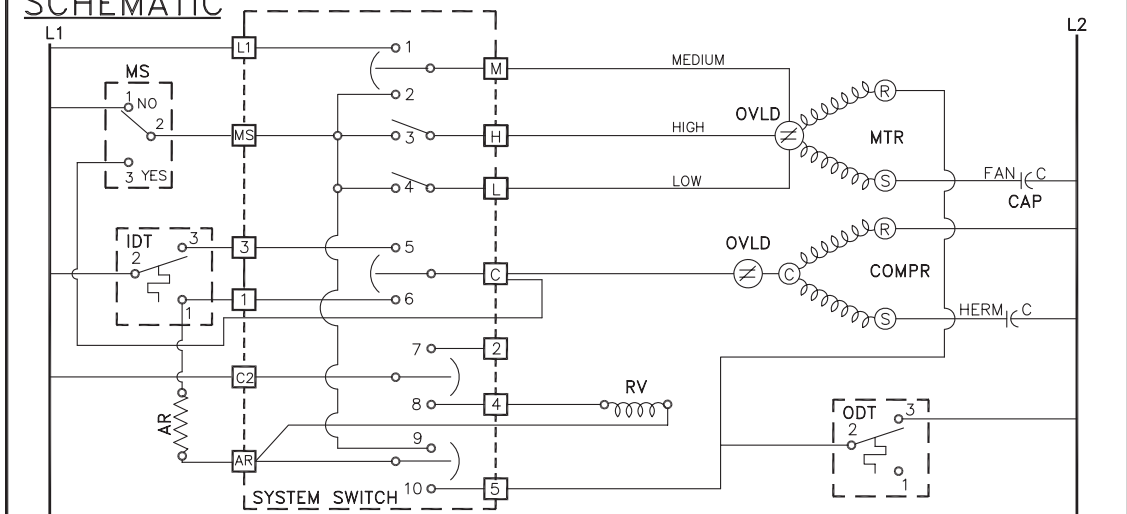
PART NO. 619-405-12 REV. 04

MODEL YQ07L10-A

WIRING DIAGRAM



SCHEMATIC



SWITCH LOGIC

SWITCH POSITION	1	2	3	4	5	6	7	8	9	10
OFF	0	0	0	0	0	0	0	0	0	0
LOW COOL	0	0	0	X	X	0	X	0	X	0
MEDIUM COOL	0	X	0	0	X	0	X	0	X	0
HIGH COOL	0	0	X	0	X	0	X	0	X	0
HIGH HEAT	0	0	X	0	X	0	X	0	X	0
MEDIUM HEAT	0	X	0	0	X	0	X	0	X	0
LOW HEAT	0	0	0	X	0	X	0	X	0	0
FAN ONLY	X	0	0	0	0	0	0	0	0	0

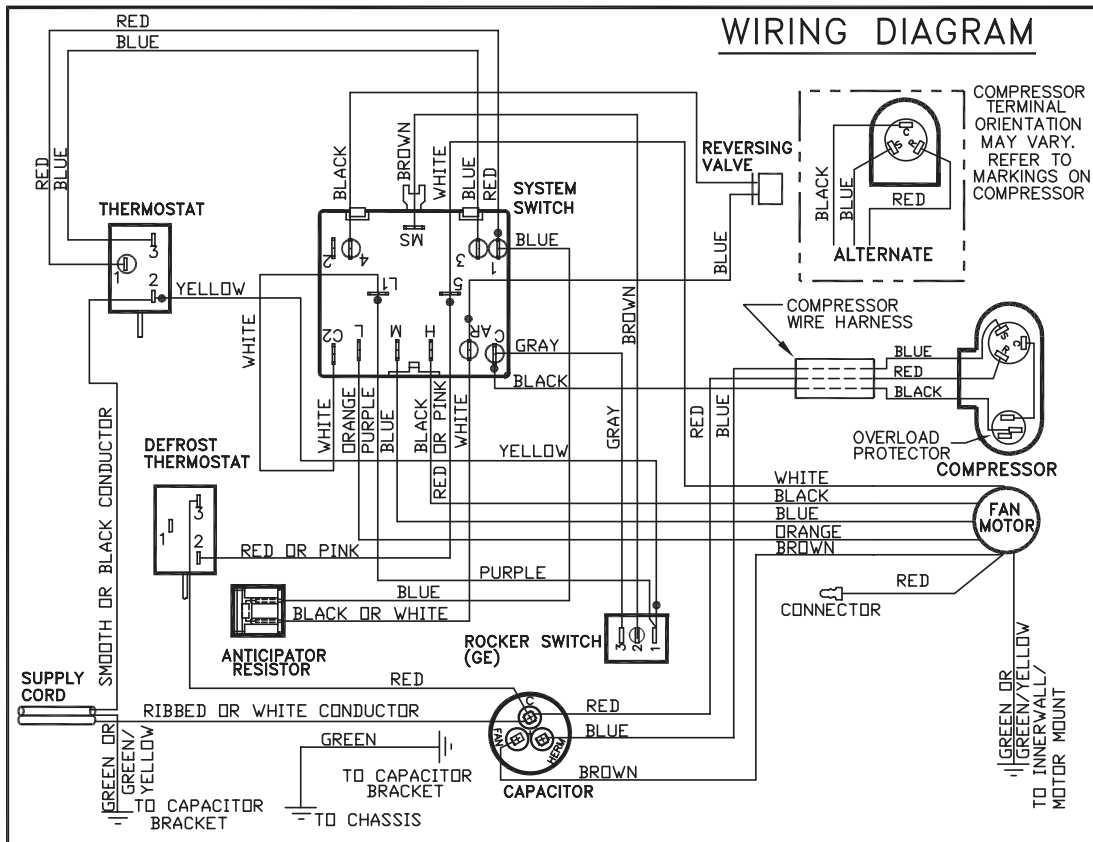
LEGEND

AR - ANTICIPATOR RESISTOR
 MS - MONEY SAVER
 CAP - CAPACITOR
 COMP - COMPRESSOR
 MTR - FAN MOTOR
 OVLD - OVERLOAD PROTECTOR
 RV - REVERSING VALVE
 IDT - INDOOR THERMOSTAT
 ODT - OUTDOOR THERMOSTAT

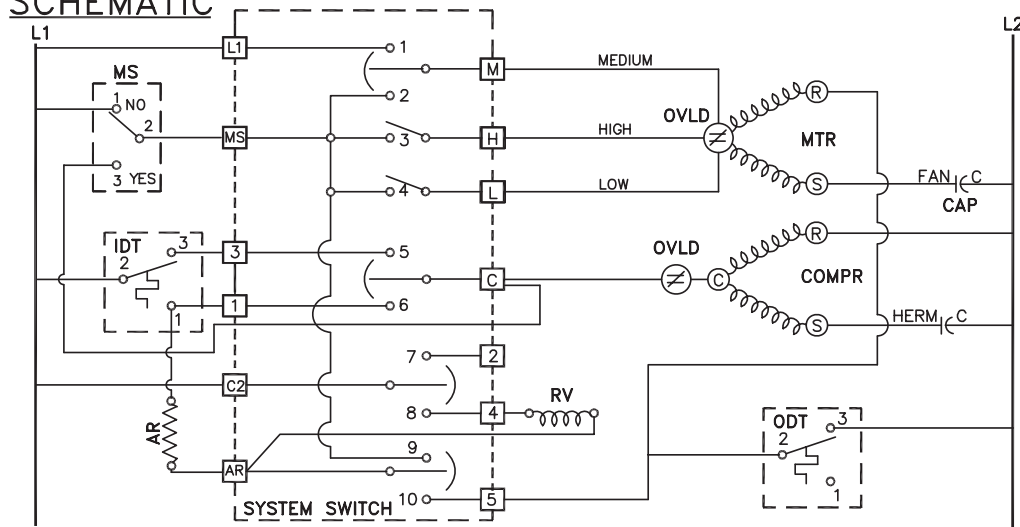
———— GROUND LEAD
 —●— COMBINATION TERMINAL
 ○— PLASTIC INSULATOR

PART NO. 619-142-18
 REV. 00

MODEL YS09L10-A, YS09L10-B



SCHEMATIC



SWITCH LOGIC

SWITCH POSITION	1	2	3	4	5	6	7	8	9	10
OFF	0	0	0	0	0	0	0	0	0	0
LOW COOL	0	0	0	0	0	0	0	0	0	0
MEDIUM COOL	0	0	0	0	0	0	0	0	0	0
HIGH COOL	0	0	0	0	0	0	0	0	0	0
HIGH HEAT	0	0	0	0	0	0	0	0	0	0
MEDIUM HEAT	0	0	0	0	0	0	0	0	0	0
LOW HEAT	0	0	0	0	0	0	0	0	0	0
FAN ONLY	0	0	0	0	0	0	0	0	0	0

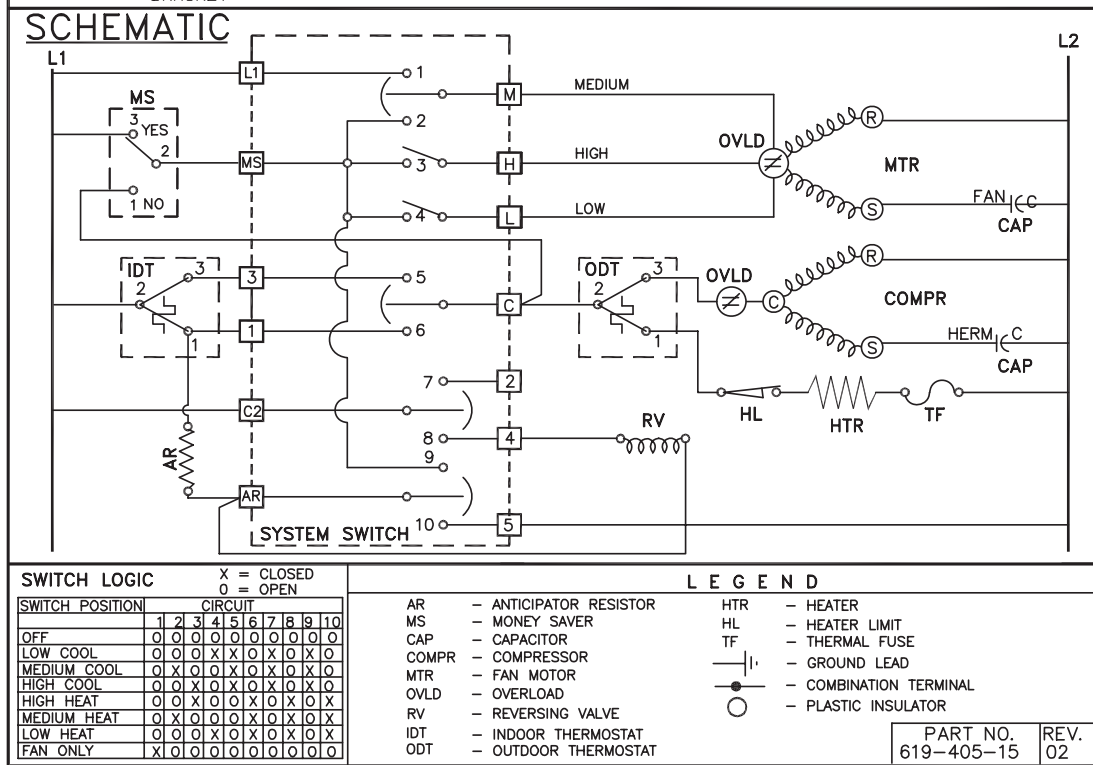
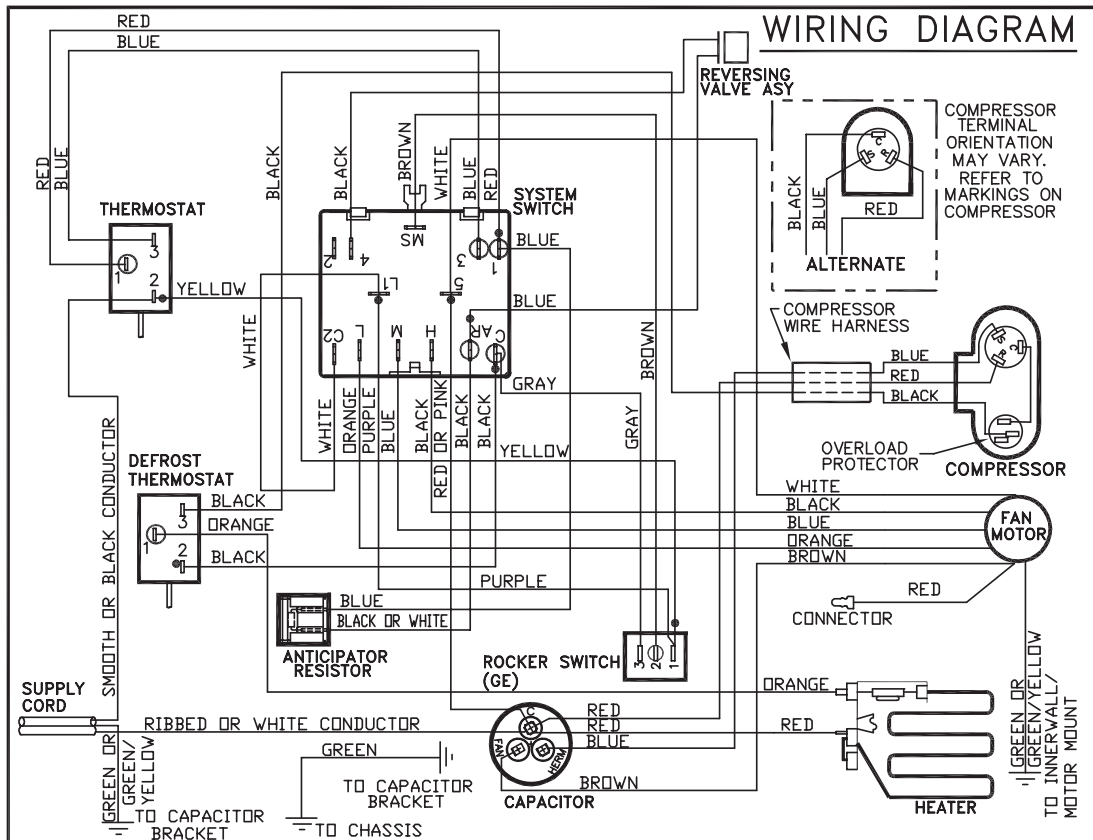
AR — ANTICIPATOR RESISTOR
 MS — MONEY SAVER
 CAP — CAPACITOR
 COMPR — COMPRESSOR
 MTR — FAN MOTOR
 OVLD — OVERLOAD PROTECTOR
 RV — REVERSING VALVE
 IDT — INDOOR THERMOSTAT
 ODT — OUTDOOR THERMOSTAT

LEGEND

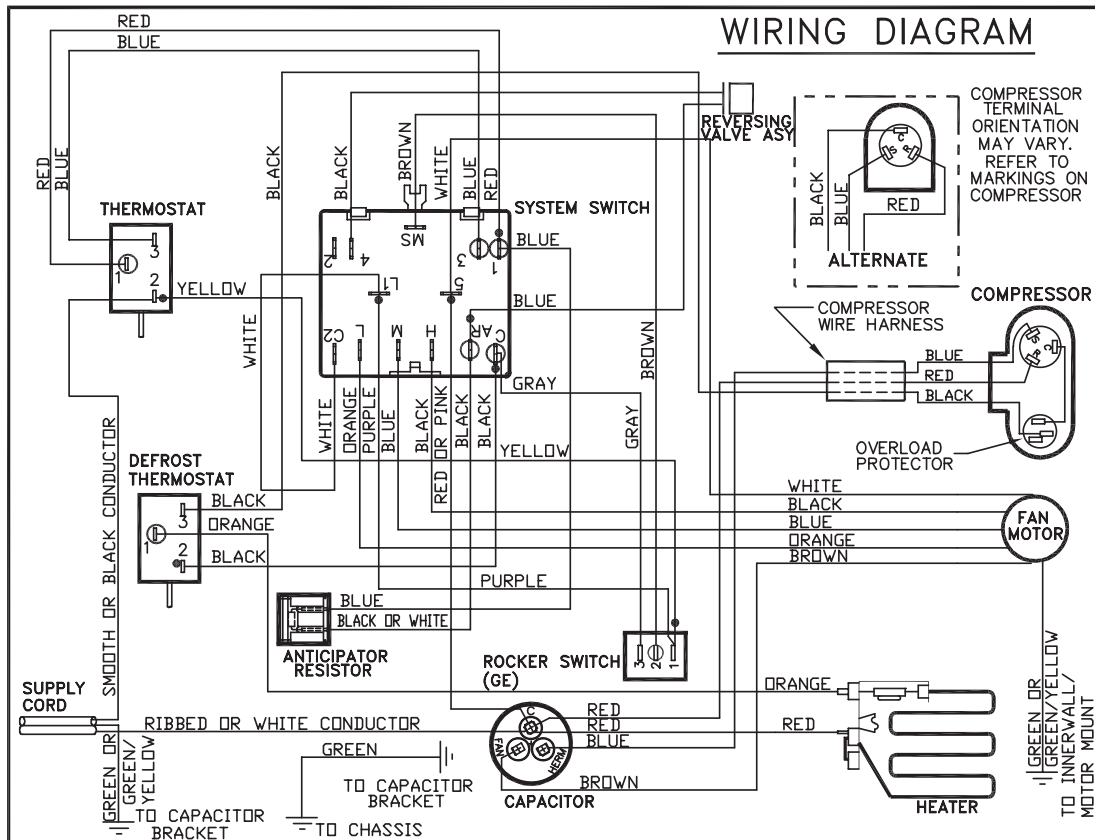
— — GROUND LEAD
 — — COMBINATION TERMINAL
 ○ — PLASTIC INSULATOR

PART NO. 619-405-17
 REV. 02

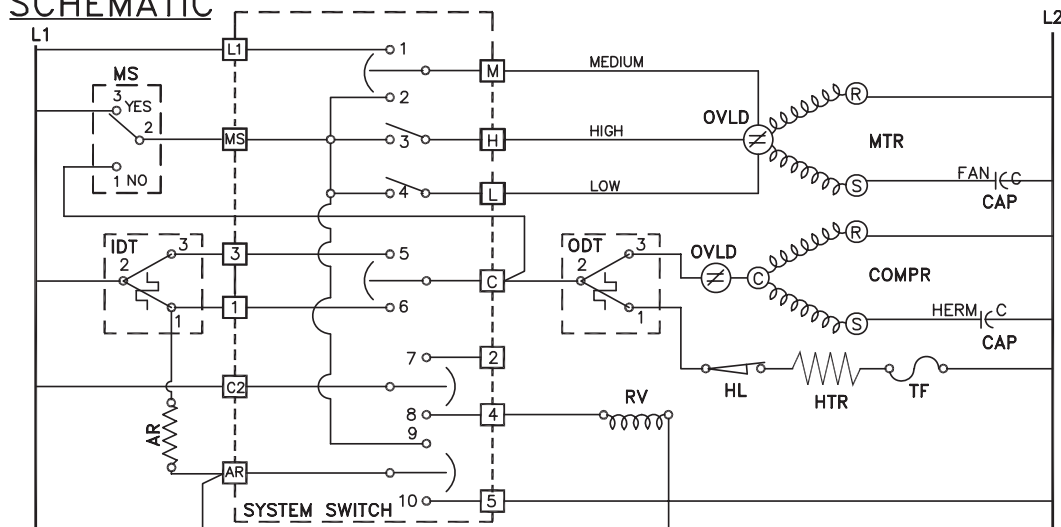
MODELS YS13L33-A, YM18L34-A



MODELS YL24L35-A



SCHEMATIC



SWITCH LOGIC

SWITCH POSITION	1	2	3	4	5	6	7	8	9	10
OFF	0	0	0	0	0	0	0	0	0	0
LOW COOL	0	0	0	0	0	0	0	0	0	0
MEDIUM COOL	0	0	0	0	0	0	0	0	0	0
HIGH COOL	0	0	0	0	0	0	0	0	0	0
HIGH HEAT	0	0	0	0	0	0	0	0	0	0
MEDIUM HEAT	0	0	0	0	0	0	0	0	0	0
LOW HEAT	0	0	0	0	0	0	0	0	0	0
FAN ONLY	0	0	0	0	0	0	0	0	0	0

AR	- ANTICIPATOR RESISTOR
MS	- MONEY SAVER
CAP	- CAPACITOR
COMPR	- COMPRESSOR
MTR	- FAN MOTOR
OVLD	- OVERLOAD
RV	- REVERSING VALVE
IDT	- INDOOR THERMOSTAT
ODT	- OUTDOOR THERMOSTAT

LEGEND

HTR	- HEATER
HL	- HEATER LIMIT
TF	- THERMAL FUSE
	- GROUND LEAD
	- COMBINATION TERMINAL
	- PLASTIC INSULATOR

PART NO. 619-405-04 REV. 03



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